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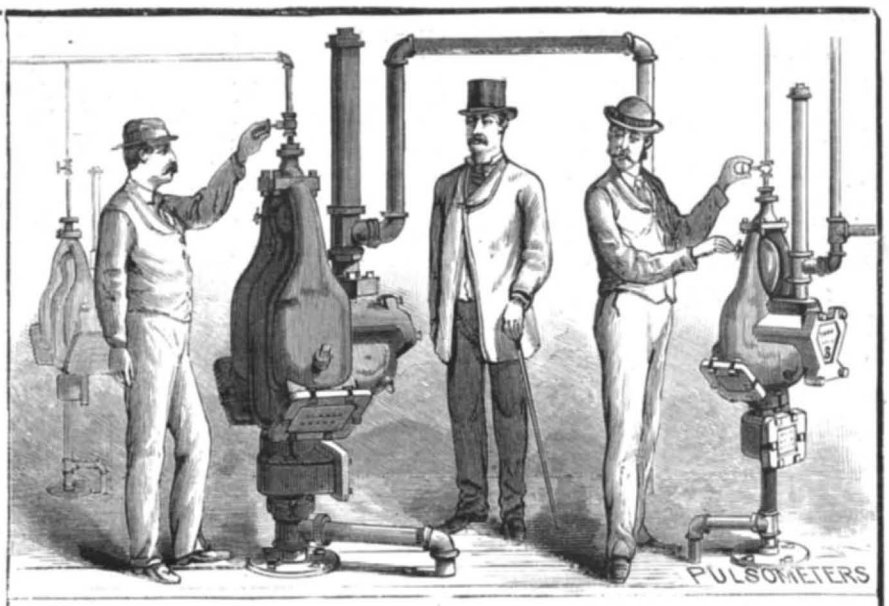

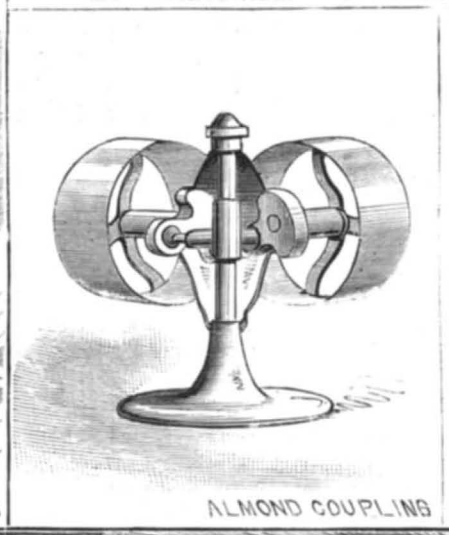

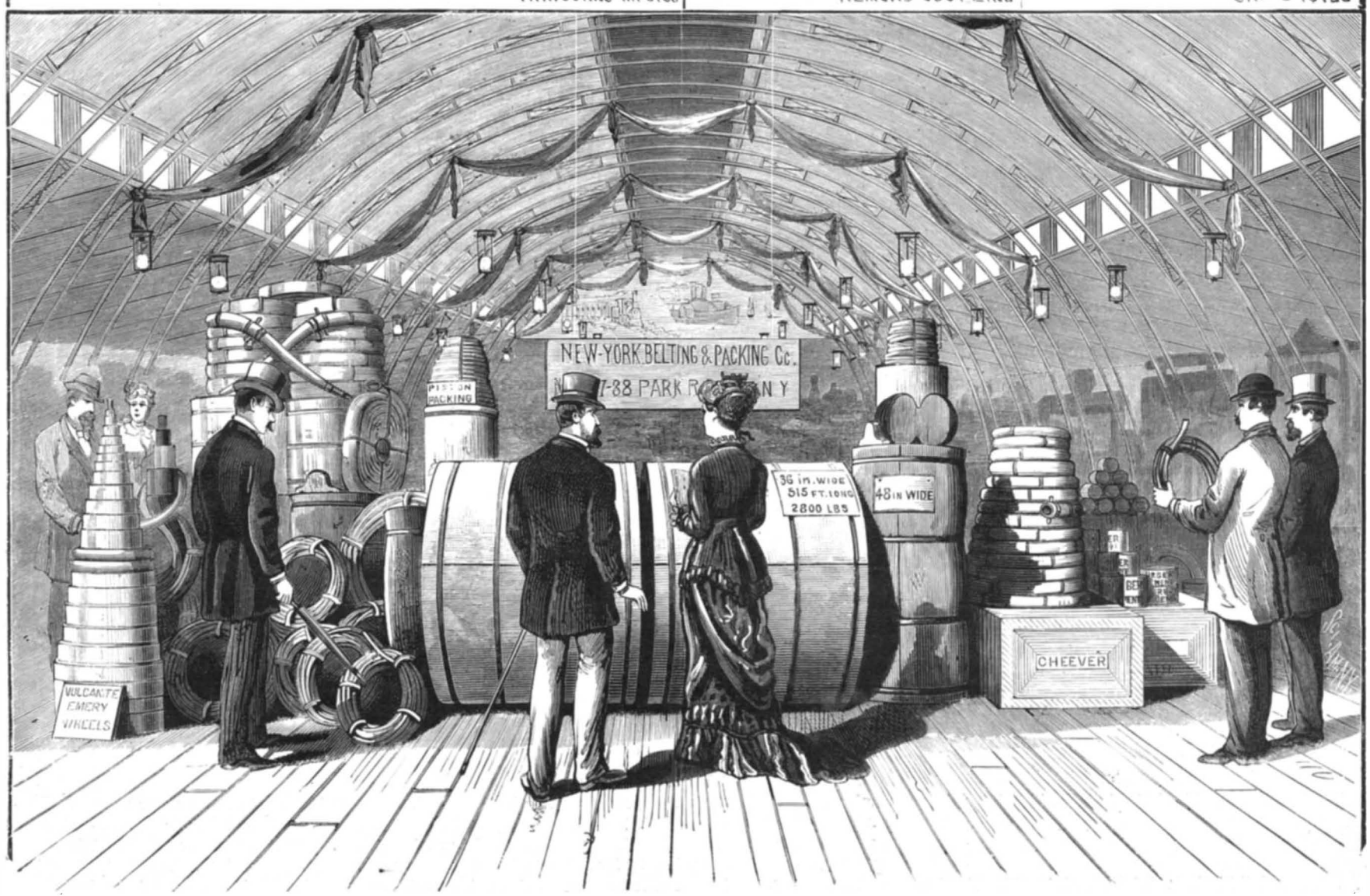

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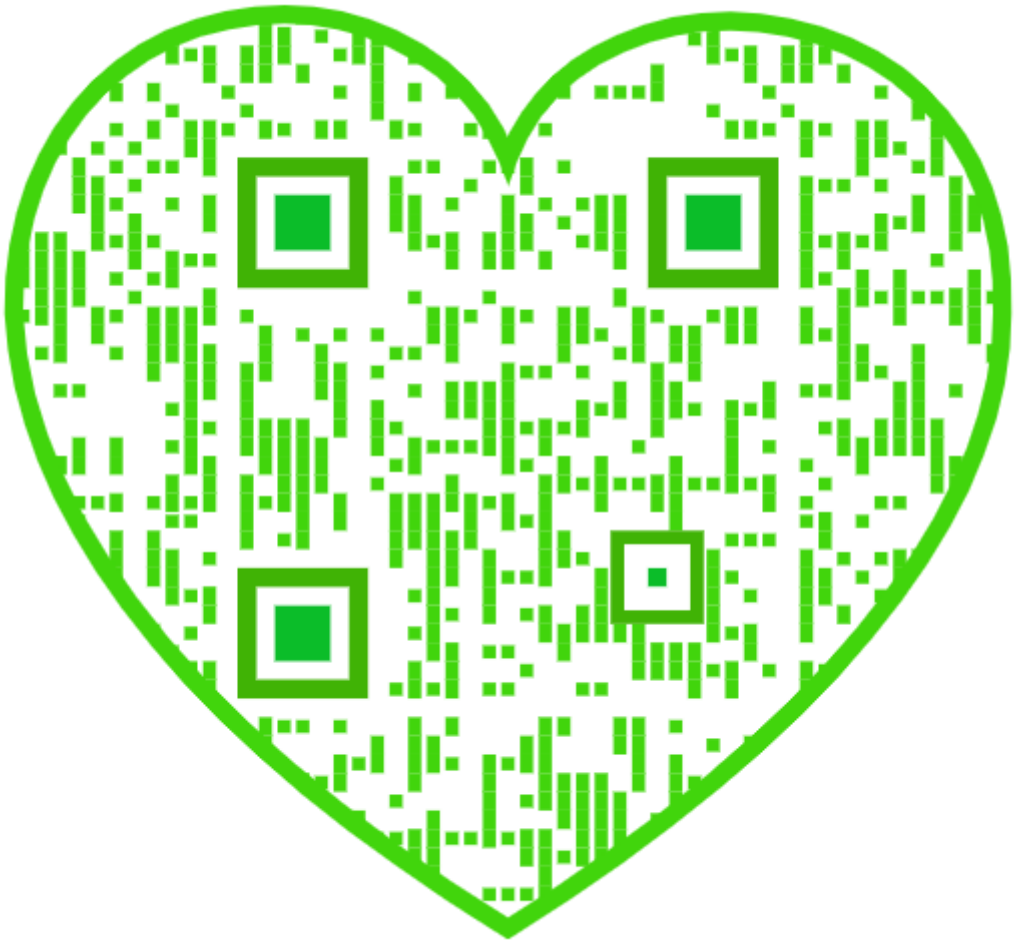

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PATENT REFORM.

About this time every year, particularly if there is no topic of general interest before the country, there appears in one or the other of our morning papers an article on patent reform, thrown out, apparently, as a "feeler." The tone and sentiment of these articles are always the same. The line of argument is substantially identical in all, and the internal evidences of style and motive strongly encourage the hypothesis that they have a common source which is not altogether unknown to American inventors and patentees. This year the *Times* gets it.

Taking for his text the late action of the English National Chamber of Trade favoring the proposed reform of the British patent law in the direction of lessened fees and extended terms of patent right, thus approximating the British system to the American, the writer objects, on the ground that it is a serious practical question whether the stimulus given by the cheapness of patents, and, still more powerfully, by the excessively easy granting, does not work injuriously to all parties except brokers and lawyers. "This excessive liberality," the writer says, "is extended so far that the law confining patents to 'any new and useful' invention is practically a dead letter. Patents are granted for devices not only not 'useful,' but for those which will not operate as intended and declared to do. . . . Nor is novelty exacted strictly enough, for every person who has examined the subject can cite devices which have been substantially patented over and over."

That the examiners in the Patent Office do not know everything and are not incapable of making mistakes the warmest friend of the patent system would not hesitate to admit; but he would hesitate, we think, to accept that as an excuse for lessening the encouragement which the patent system holds out to inventors. It is presuming a great deal to assume, as the *Times* writer does, that our inventors generally are mentally incompetent and need to be protected against their own unreasonable eagerness to pay their money for letters patent on things that are of no use.

The writer continues:

"A patent worth having is worth paying for much more heavily than is now charged; but the worthless ones, now far the majority, are an injury. Any change which tends to lessen these, without working too much offsetting harm, will prove a public benefit. It is plain that if government could practically make the successful invention pay accordingly there could be no reasonable objection; the difficulty in this is to pick out the successful ones at first, or to follow up the list and sift out the good ones afterward, but this work is fairly well done automatically by natural selection. Inventions which prove commercially valuable can afford to bear supplementary taxes, and those which are not worth payment will escape it. Hence the English system of supplemental fees is thoroughly sound, taxing patents which can bear it and extinguishing the useless ones. This extinguishment is itself very valuable, for a useless patent often becomes vexatiously obstructive."

Here are the old familiar sophistries. The underlying assumptions are all opposed to the spirit and policy of the system which has so bountifully demonstrated its practical wisdom that even conservative England is beginning to appreciate it.

The idea that an inventor, who has brought forth, painfully or otherwise, something of value to the rest of the community, should be compelled to pay for the privilege, heavily or lightly, is simply absurd. That the penalty imposed should increase with the amount of the benefaction is still more absurd. Indirectly the successful invention does contribute to government support in taxes in proportion to the rate at which it increases individual and public wealth; but that is for service by the government other than and independent of the issuance of an official certification of the invention in the form of letters patent. The assertion that the majority of patents are worthless is so contrary to the evidence of fact that it cannot be set down to ignorance. The point of the whole paragraph lies in the advocacy of the policy of extinguishing "useless patents;" and its mischievousness turns on the assumption that all patents which are not speedily developed and made commercially productive are useless. This position too is flatly contrary to the evidence of fact, as shown in history and illustrated in the testimony taken in official investigations in this country and in Europe.

It is the position taken by those, and those only, who are pecuniarily interested—as principals or attorneys—in so modifying the operation of the patent law as to facilitate the seizure and enjoyment of patented inventions without the preliminary formality of consulting the inventor or incurring any subsequent risks of damages for infringement. With a large number of classes of inventions it rests with a few wealthy organizations to decide absolutely whether a new invention within the class, however meritorious it may be, shall or shall not be speedily developed and made remunerative to the patentee. Such organizations, or many of them, would no doubt assent heartily to the *Times* writer's position that "the extinguishment of all [patents] which do not develop value within a term of years would be beneficial;" but the public who do not wish to wait for improvements until the patents on them have been officially killed, and the inventors who invent primarily for their own betterment and not to swell the income of railway companies and the like, are inclined to take another and more equitable view of the rights of the patentee, and at the same time prefer that the benefits to be derived from inventions shall be more equitably distributed.

HAMILTON E. TOWLE.

The recent death abroad of Hamilton E. Towle, inventor, mechanical engineer, and manufacturer, of this city, recalls the remarkable achievement which first brought his name prominently before the public. In September, 1861, Mr. Towle, then a young graduate of the Lawrence (Mass.) Scientific School, was a passenger on the Great Eastern, from Liverpool to New York, when her rudder post was broken in a storm. Seeing that the efforts of the ship's officers to retrieve the disaster were useless or worse, young Towle drew up plans for a temporary steering apparatus, and, backed by some prominent American passengers, was granted a hearing and grudgingly allowed to carry his plan into effect, thereby saving the ship, which had been rolling helplessly in the trough of the sea for many critical hours. This historical feat of engineering, requiring infinite pluck and skillful labor as well as rare genius, was described at length and illustrated by engravings in the SCIENTIFIC AMERICAN of October 26, 1861.

Mr. Towle was a mechanical experimenter and inventor from boyhood, and his active and ingenious mind bore good fruit for many years. Previous to his last illness Mr. Towle was at the head of the Towle Manufacturing Company, of this city.

The Microphone in Observatories.

Mr. Van Rysselberghe's idea of using the microphone in observatories has been adopted in the observatory at Geneva, and by the aid of the instrument, in combination with the telephone, the sound beats of the normal pendulum can be heard in every part of the building. The observatory is also connected with the Hôtel Municipal, so that the beats of the electric clock regulator in that building can be heard and compared with the pendulum beats.

A Large Refrigerating Machine.

The Boyle Ice Machine Company, of Chicago, have undertaken to cool artificially the beer storage and fermenting rooms of the Philip Best Brewing Company, of Milwaukee. The capacity of the rooms to be cooled exceeds 1,600,000 cubic feet. The contract price of the refrigerating machinery is $80,000. It is estimated that at least twenty freight cars will be required to transport the machinery and connections, exclusive of the steam boilers. The Boyle Company employ the ammonia process.

The Lighthouse Service.

There are now under the control of the Lighthouse Board about seven hundred lighthouses, besides something like eight hundred lights, on interior rivers. In their annual report the Board ask for $50,000 to introduce electric lights in several of the more prominent lighthouses. The lamps proposed for this purpose have been thoroughly tested, and are said to be in every way satisfactory and much more effective than the lights now in use. The estimates for new work and for the maintenance of the service amount to about $3,000,000.

A Railway Injured by an Earthquake.

A severe earthquake was lately felt in the southern part of the North Island, New Zealand. No lives were lost, but in some of the townships in the Manawater district scarcely a chimney was left standing. In Foxton, for instance, no less than 250 were thrown down. Fissures extending for many miles are reported to have been made, and the railway line was rendered unsafe in that neighborhood, owing to the undulations of the earth alternately raising and depressing the rails. Since the large shock a good many of a slight nature have occurred.

Constant Sources of Electricity.

A section suitably cut in a hemihedral crystal with inclined surfaces and placed between two leaves of tin, constitutes a condenser which is capable of charging itself when compressed. With this system we may realize a new instrument, a condenser source, which possesses special properties. It may serve as a standard of static electricity for measuring charges and capacities. The authors give in this memoir an absolute measurement of the quantities of electricity liberated by tourmaline and quartz under a given pressure.—*MM. Jacques and Pierre Curie.*

Angular Distance of Colors.

The projection of a table of colors upon the sides of an equilateral triangle renders it possible to determine the exact angular distance of the colors, a result which has not yet been obtained, and which suffices to connect together the facts at present known. The author gives a diagram representing the law of the mixture of colors, and which will be advantageously substituted for Newton's rule.—*A. Rosenstiehl.*

Underground Telegraph in Philadelphia.

The work of laying the conduit for the underground telegraph system on Market street has now proceeded as far as Eleventh east from the public buildings, and work is progressing at the rate of half a square a night. The conduits have twenty separate chambers. Each chamber has a capacity for fifty wires, and connection is made by means of manholes, which are located at each square.—*Philadelphia Record.*

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THE COTTON PLANT AND ITS FIBER.

Linnæus recognized five primary species of the cotton plant. Other botanists have made the number seven, eight,

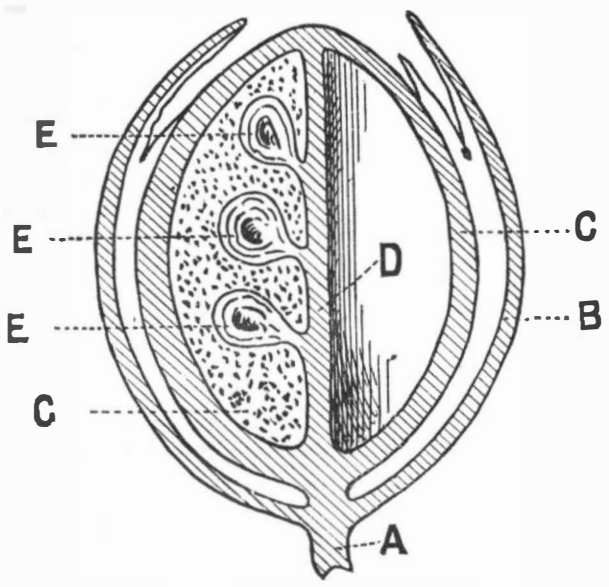


FIG. 1.

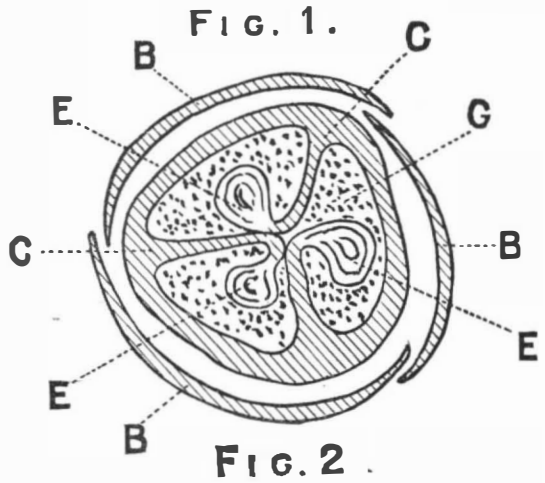


FIG. 2.

A. Stem.—B. Section of calyx.—C. Section of carpel.—D. Midweb with seeds attached.—E. Section of seeds.—G. Plexus of young cotton fibers.

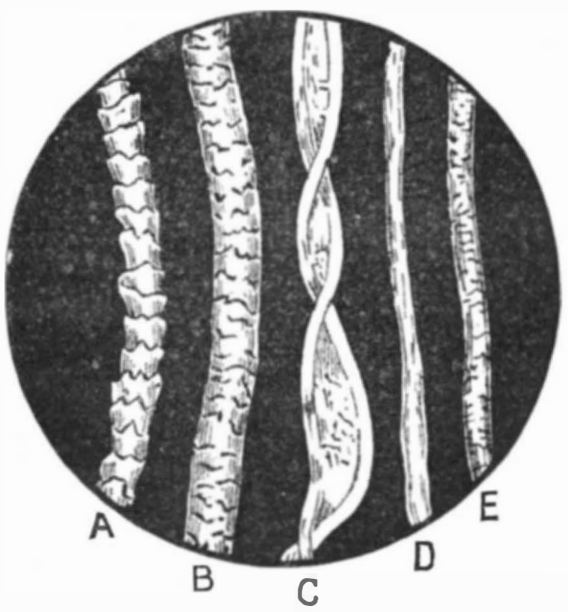
LONGITUDINAL AND TRANSVERSE SECTIONS OF EGYPTIAN COTTON POD.

and even ten. One of the later authorities, Professor Parlatore, finds seven species:

1. *Gossypium arboreum,* which occurs in Ceylon, the Moluccas, Arabia, Senegal, etc.
2. *G. herbaceum,* growing in Siam, China, India, Italy, etc.
3. *G. sandwichense,* from the Sandwich and other Pacific islands.
4. *G. hirsutum,* which furnishes our American upland cottons.
5. *G. barbadense,* including the Sea Island and Barbadoes cottons.
6. *G tahitense,* from Tahiti, the Society Islands, etc.
7. *G. religiosum* or *peruvianum,* which comprises Peruvian and other cottons with seeds in adherent files.

In his new and valuable work on the "Structure of the Cotton Fiber in its Relations to Technical Applications," Mr. F. H. Bowman holds that the best practical division is that of herbaceous, shrub, and tree cotton. The herbaceous cotton is the most valuable, and is that from which the large American crop is obtained.

Fig. 3.—(325 Diameters.)



A. Fiber of Chinese wool.—B. Fiber of Leicestershire wool.—C. Fiber of cotton.—D. Fiber of silk.—E. Fiber of mohair.

The cottons grown in different parts of the world differ in the length and fineness of the staple, the range being between the short native cotton of India, with a fiber scarcely exceeding three-fourths of an inch, and the long stapled Sea Island cotton grown on the shores of Georgia and Florida, with a fiber over two inches long.

Mr. Bowman gives (pp. 99, 100) a table of the various classes of cottons quoted in the Liverpool market, giving the name, place of growth, species, average length of staple, and the spinning "counts" for which each is generally used.

The "Sea Islands" cottons (*G. barbadense*) are used for all the finest counts, which are spun up to 2,000s. The cotton from the coast of Georgia and Florida stands at the head, with an average length of staple of 2·20 inches.

Next comes the cotton of the same species, grown on Florida uplands, with a staple 1·95 inches long. The same grown in Australia and the Pacific islands measures from 1·65 to 1·88 inches. The so-called Sea Islands cotton from Venezuela (La Guayran, *G. hirsutum*) measures 1·75 inches; while that from the coast of Peru (*G. peruvianum*) measures 1·50.

Next in length of staple comes "Egyptian cotton," the best of which (from *G. barbadense*), with a staple of 1·50 inches, is spun up to 200s. The brown Egyptian (from *G. herbaceum*) has a staple of 1·40 inches, and is spun up to 140s. The white Egyptian (from *G. hirsutum* and *G. peruvianum*) has a staple of 1·25 inches, and is spun up to 80s. The Smyrna cotton, from the Levant and Greek islands, is classed with, and is almost equal in quality to, the last named.

Next in order come the "Brazilian" cottons, which include all the South American and West Indian products, except the long-staple cottons already named. The staple ranges between 1·15 inches and 1·35 inches. Alone and mixed with American and Egyptian cottons the Brazilian cottons are spun up to 60s.

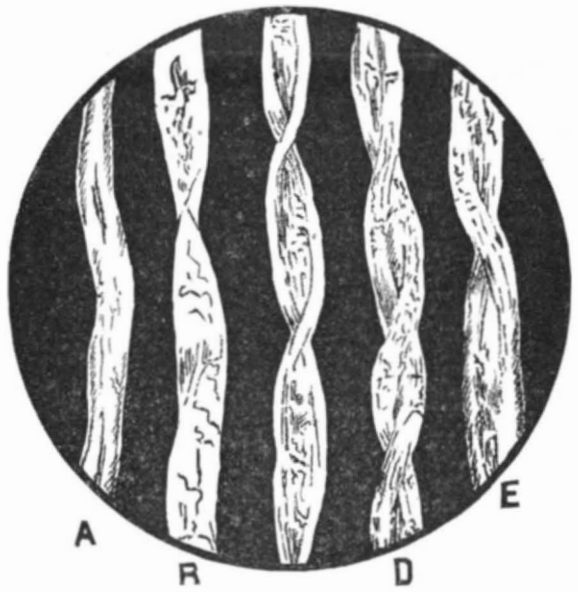
"American" cottons comprise those known as *Upland,* from Georgia and South Carolina; *Mobile,* from Alabama and adjacent States; *Orleans,* from Mississippi, Arkansas, and Louisiana; and *Texas,* from that State. The species is *G. hirsutum,* and the average lengths of staple are, in the order named: 1 inch, 1·05 inches, 1·10 inches, and 0·95 inch. Alone these cottons are spun up to 50s; mixed with Egyptian and Brazilian, up to 60s.

The "Indian" or Surat cottons, and the "Madras" cottons, under eight or ten special names, include the products of the several divisions of Hindostan and British Burmah. The staple varies between 0·90 inch and 1·20 inches, the shortest being "Rangoon," from Burmah, the longest, "Hingunghat," from the Central Provinces. Alone these cottons are spun up to 32s; mixed with American, up to 40s.

The "African" cottons are of like grade with the Indian. These, of course, do not include the Egyptian.

By "counts" in the foregoing descriptions is meant the number of hanks of 840 yards spun from one pound of cot-

Fig. 4.—(325 Diameters.)



A. Glassy, structureless fiber.—B. Thin, pellucid, unripe fiber.—C. Half ripe fiber, with thin cell wall.—D and E. Fully mature and ripe fiber, with full twist and thick, well-defined cell wall.

ton; a count of 200 means 200 × 840 yards, or 168,000 yards to the pound. American Sea Island cotton has been spun into counts as high as 2,150 hanks to the pound, so that one pound of this yarn would have a length exceeding 1,000 miles. The short American staple will average about 30 miles of yarn to the pound, as it is ordinarily spun.

A ready conception of the relative proportions of the cotton fiber may be obtained by supposing the fiber magnified until it should be one inch in diameter. In this case the ordinary American cotton fiber would measure 100 feet in length, while an average fiber of Sea Island cotton would reach over 130 feet.

The fineness of the fiber may be judged from the fact that it takes from 14,000 to 20,000 filaments to weigh a grain. If the separate fibers of a pound of ordinary cotton could be placed end to end in a straight line they would reach about 2,200 miles. The fibers are far from uniform in length, the longest, as a rule, being those which grow on the crown of the seed; the shortest grow at the base of the seed. The manner in which the fiber is distributed about the seeds in the boll is shown in Figs. 1 and 2.

The relative strengths of the different sorts of cotton fibers have been partially investigated by Mr. C. O'Neill. The results as quoted by Mr. Bowman are arranged as follows, the weights indicating the mean breaking strain: Sea Island (Edisto), 83·9 grains; Queensland, 147·6 grains; Egyptian, 127·2 grains; Maranham, 107·1 grains; Benguela, 100·6 grains; Pernambuco, 140·2 grains; New Orleans, 147·7 grains; Upland, 104·5 grains; Surat (Dhollerah), 141·9 grains; Surat (Comptah), 163·7 grains. In proportion to the sectional area of the fiber the Egyptian cotton appears to be relatively strongest. In the other cases the breaking strains are roughly proportional to the coarseness of the fiber. These measurements are set down as approximate only.

When examined under the microscope the cotton fiber is usually seen to be an irregular, flattened, somewhat twisted tube; frequently the tubular form is lost by collapse, the fiber appearing ribbon-like, with the edges thickened.

In Fig. 3, copied from the work of Mr. Bowman, the appearance of the fiber is contrasted with that of fibers of wool, silk, etc.

Mr. Bowman finds that, speaking generally, cotton fibers may be divided into three classes:

1. Those in which no internal structure is apparent.
2. Those in which the structure seems to be simply tubular, with a well-defined transparent cell-wall.
3. Those in which the structure is tubular and the interior of the cell is filled with secondary deposits, almost entirely

Fig. 5.—(450 Diameters.)

A. Unripe unmatured fibers.—B. Half ripe fibers.—C. Fully matured and ripe cotton.—D. Section of fiber showing laminated cell walls.

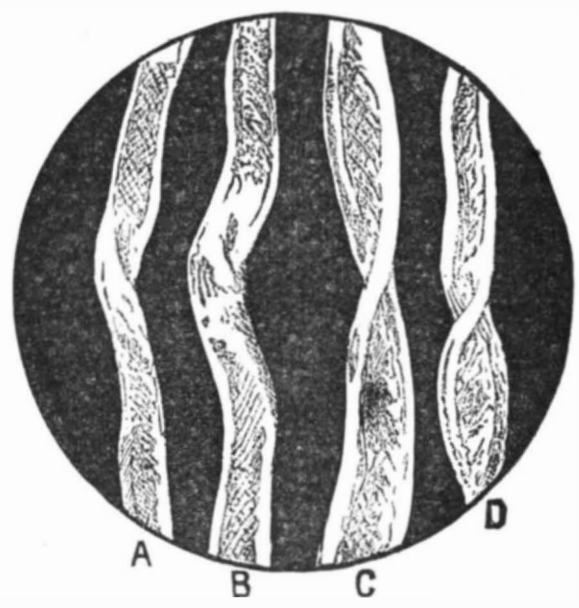
SECTIONS OF COTTON FIBER.

filling up the cavity and giving the fiber a dense, almost opaque appearance.

The first of these classes occurs most frequently in early and unripe cotton, and apparently also in cotton which is overripe from having been left too long ungathered. In both cases the outer sheath of the fiber seems to be of extreme thinness.

The structureless appearance of unripe cotton is attributed to the fact that the fiber has been detached from the seed before the period when the filling up of the interior of the elongated cellular sac which forms the fiber has commenced; in the overripe cotton the thickness of the outer wall seems to have been reduced by the process of absorption which sets in when an organic structure has reached maturity. In certain other fibers the lack of internal structure is partial, portions of their length appearing solid and incapable of absorbing dyes, a condition analogous to "kemps" in wool. This kempy structure seems to be more frequent in short than in long fibers, and probably varies with the climatic and other conditions of the growth of the plant.

Fig. 6.—(300 Diameters.)



A and B. Fibers of wild African cotton.—C and D. Fibers of coarse Peruvian cotton.

COTTON FIBERS SHOWING SPIRAL STRUCTURE.

The third class of fibers are the most valuable, since they absorb dyeing materials best, and in some cases retain the dye in the inner tube in crystalline masses. When acted upon by many chemical reagents the rigidity and solidity of the tube walls of these fibers appear to be increased, and in some cases the thickness of the wall also. Mr. Bowman says of these: "It seems as if in this fully matured fiber the central cells, up which the sap passed during the period

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of growth, had been fully absorbed into the tube wall when the full length of the hair was reached and the vital action which kept the cell contents in activity [was] arrested; and while the interior cells are fully matured they are shrunk in toward the denser walls which form the outer sheath, but without losing their structure, so that they are ready to be expanded again when their interior is filled with fluid or solid contents, as the case may be. In this class of fibers the central tube is always well defined. Of course, as in the case of the second class, the irregularities and twists in the fibers are quite visible, and they shade into the first and second varieties; but they form by far the largest portion of every cotton sample, and hence may be taken as the typical fiber.

In Fig. 4 are represented these three classes of fibers. Fig. 5 exhibits a number of sections of cotton fiber, as found in the different stages of growth. Fig. 6 shows the spiral structure of different cotton fibers.

Unfortunately Mr. Bowman's examinations were made at a distance from the cotton field, so that he was unable to study the mutual relations of the different parts of the fiber and of the different kinds of fiber in the green or growing state. His specimens were all selected after the cotton had been not only dried, but ginned and pressed. A corresponding study of the varying appearance of the fiber in its natural course of development could not fail to be valuable

Technical Teaching in England.

The increasing interest in technical instruction in England is shown by the fact that more than 2,500 students were taught in the classes of the London City and Guilds Institute last session. The third examination of the Institute was held lately at 115 centers. Out of 1,563 candidates 895 passed in one, and 65 in two subjects. The number of papers examined this year by the Institute was 1,776, of which 484 were for outside students.

RECENT INVENTIONS.

An improved coin holder has been patented by Mr. John Chantrell, of Bridgeport, Conn. The object of this invention is to hold rolls of coin in such a manner that the coins can be readily seen and counted and conveniently handled.

Mr. Jacob G. Titus, of Silver Cliff, Col., has patented an improvement in that class of journal bearings in which friction is relieved by use of balls or rollers interposed between the journal and its box or casing. The improvement consists in the construction of an axle journal box which adapts it to receive anti-friction balls, and also in the provision of elastic and anti-friction end bearings for receiving the end movement or thrust of the axle journal.

An improved cornstalk shocker and binder has been patented by Mr. John B. Whitbeck, of Coxsackie, N. Y. The invention consists in a roller supported by standards and carrying a transverse bar and a cord for drawing the stalks together to be bound. After binding the shock the roller and transverse bar may be removed.

Mr. Adrian C. Selby, of Covington, Ky., has patented an improved soap composed of tallow, olive oil, sal-soda, unslaked lime, rosin, borax, alum, white wax, spermaceti, and benzine.

An improved game has been patented by Mr. Stephen W. Roe, of Albany, N. Y. The object of this invention is to provide a new and simple game which is played in the same manner as billiards.

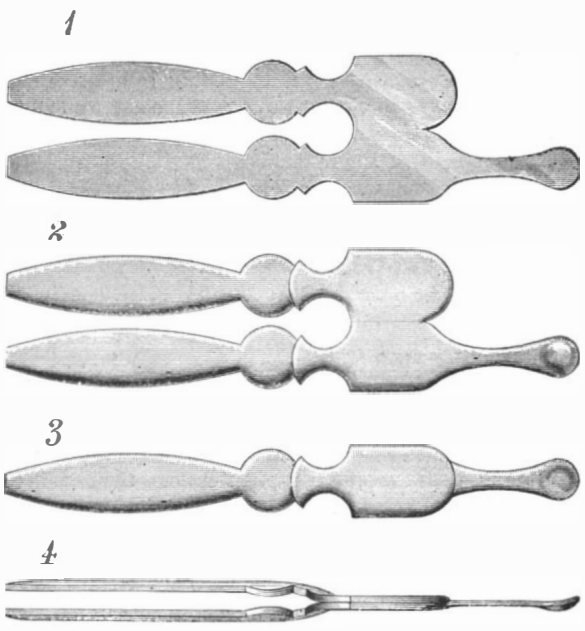
Anna M. Knoop, of New York city, has patented an improvement in crochet goods, which can be used as hat frames, book satchels, sewing baskets, etc. The invention consists in an article of crochet work which is stiffened by means of glue, gelatine, or similar substance, is then dried on a mould, which gives it the desired form, and is then protected with a suitable varnish.

Mr. John L. Symonds, of Detroit, Mich., has patented an improved trap formed of two trough or tray shaped wire netting sections hinged to each other and pressed toward each other by spiral springs on one of the sections. The trap is provided with a bait hook having a catch at the upper end, which catches on a bail of the other section and holds the sections separated; but as soon as an animal bites on the bait the bail is released and the springs force the two wire netting sections together, thus entrapping the animal.

IMPROVED INVALID BED.

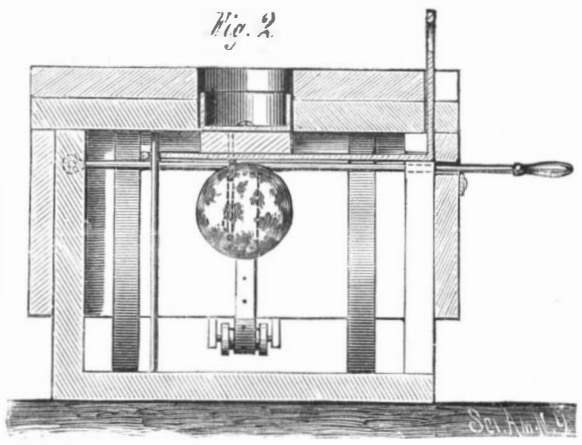
The engraving shows an improved invalid bed recently patented by Mr. George B. Davis, of Richmond, Va. It is constructed so that the head, back, and legs of the patient can be raised or lowered with very little effort on the part of the attendant, and without any exertion whatever on the part of the patient.

The bed is provided with a pivoted leg and foot support, which may be raised or lowered at pleasure, by means of a rope or strap attached to the support and extending upward over the foot of the bed frame. The head support is hinged, and its free end is sustained by a powerful curved spring having sufficient strength to support the headpiece and the portion of the patient's body reclining thereon. A strap attached to the free end of the headpiece extends downward, and passing under a roller is finally drawn through a buckle secured to the head of the bed. The patient's head, shoulders, and the upper portion of the body are drawn down by means of the strap, against the pressure of the spring, and the head support may be fastened at any desired inclination by securing the strap in the buckle.



IMPROVED TWEEZERS.

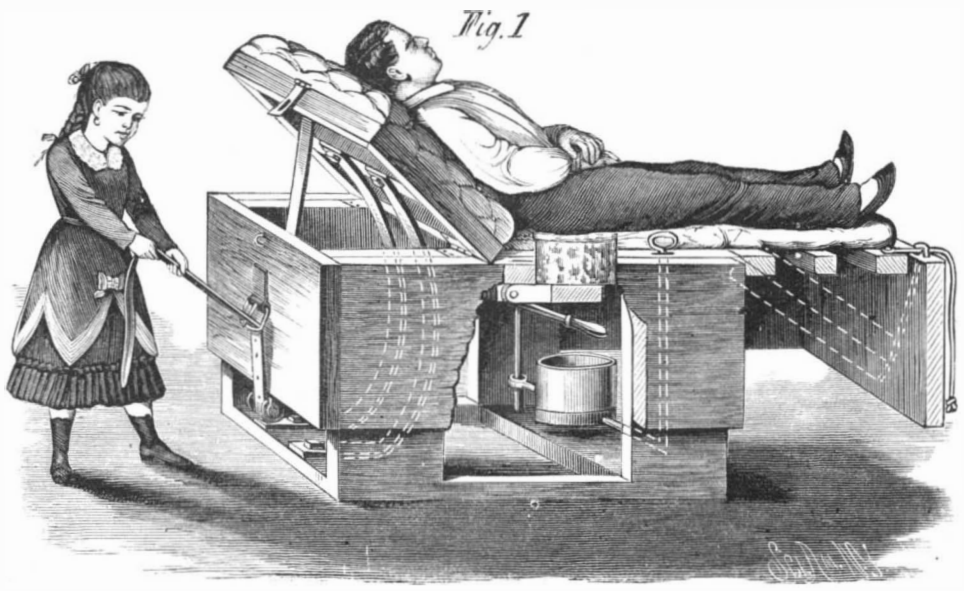
Fig. 2



SECTIONAL VIEW OF INVALID BED.

Both bed frame and mattress are apertured to receive a vessel contained in a movable case attached to a lever arm, by means of which it may be moved up or down or swung around, as circumstances may require.

Fig. 1



DAVIS' INVALID BED.

The aperture in the mattress is stopped by a cushion when the vessel is not in use. The cushion is secured to an arm hinged to the under side of the bed frame, so that it is always ready for use.

This invention will afford comfort and relief to invalids, and will greatly lessen the labor of nurses and attendants.

Apples for Cows.

Apples, like other succulent food, are good for cows and increase their milk, provided the feeding is begun cautiously in the first place, and gradually and regularly increased. But when cows break into orchards and over-gorge themselves, fever and bloating may follow, accompanied with loss or diminution of milk.

IMPROVEMENT IN THE MANUFACTURE OF TWEEZERS.

The engraving shows an improvement in the manufacture of spring tweezers, in which the two blades and body consist of a single piece of sheet metal having the two parts of the body and blades connected by a longitudinal bend in the body. This novel method of making tweezers, or tweezers and ear spoon, from a single piece of sheet metal, has been patented by Messrs. F. L. & J. M. Ellis, of Milldale, Conn. The finished article and the several stages of its manufacture are illustrated in the engravings.

Fig. 1 is a plan view of the first stage of the blank; Fig. 2 is a plan view of the second stage of the blank; Fig. 3 is a transverse section of the third blank, the plane section extending through the body which unites the tweezer blades; and Figs. 4 and 5 are side and edge views respectively of the finished tweezers and ear spoon.

The first operation is to cut out from sheet metal —preferably steel—the twin blank, Fig. 1, it being of a proper shape for forming the two blades, the body, and the ear spoon, all formed in one and the same piece of flat sheet metal, and united at the body portion of the blank, while the blades are otherwise separate from each other, as shown. The next operation is to strike the first blank in a swaging die, to round up and hollow the blades and the spoon, as shown in Fig. 2. Then the body portion of the blank is bent, so that the two parts come toward each other. The blanks are then struck in dies, which bring the two parts of the body together and set them firmly in place, and slightly offsets the shank of the spoon at its junction with the body of the tweezers, to bring it nearer the middle of the thickness of the double body, as shown in Fig. 5. These dies may also round off and remove the sharp edges from the corners of the body and spoon. The corners of the blades may be rounded off in the second set of dies. When thus treated the article is finished, ready for polishing by tumbling and otherwise.

The Vandenbergh "Sea Messenger."

During a recent cruise of the British reserve squadron a trial was made of the new sea messenger invented by Mr. Julius Vandenbergh, of Portsmouth, England. The "messenger" consists of a vessel pointed at each end, three feet six inches in length, made of copper, and lined with cork and composition to resist external pressure. The inner case will carry a weight of sixty pounds, and is designed for the conveyance of letters and other papers from wrecked or disabled vessels. The messenger was thrown over from the Hercules flagship in latitude 56.49 W., longitude 41 E., on the 24th of July. It was picked up on the 18th of August by a fisherman off Hanstholmen, Jutland, and, although it had been twenty-five days in the water, and had traveled about 1,420 miles, it was quite uninjured.

Improvement in Teaching Deaf Mutes.

The Pennsylvania Institution for the Deaf and Dumb has established a school for the tuition of deaf mutes in facial articulation, so as to enable the children, by expression of the face, to understand what is said, and they in turn may, by imitation, pronounce words in answer. This will enable them to communicate with the world at large, although they are not able to hear, and is an advance upon the sign language now in use.

The principal selected is Miss Garrett, an experienced teacher, who has hitherto been engaged in that branch of teaching in New England. This is the first effort of the kind made in Pennsylvania. There are two such schools in Massachusetts and one in New York.—*Philadelphia Bulletin.*

Large Sugar Refinery.

The greatest sugar refinery in the world is now under construction on tidewater, San Francisco. The brick building facing deep water in South San Francisco will be 400 x 150 feet, and thirteen stories high (140 feet). A salt water supply of 3,000 gallons a minute is drawn from the bay, by a tunnel, for the monster condenser. By March next it will be finished at a cost of $1,250,000. Its yearly capacity will be 60,000 tons of refined sugar. Claus Spreckles is the master spirit. It is a result of the reciprocity treaty, by which Sandwich Islands raw sugars are admitted free of duty. He has now thirty vessels employed (all built there) plying between the islands and San Francisco. He has planted sugar cane on a large scale on islands hitherto wild and uncultivated. He has tapped the mountains, and every acre is irrigated. He buys all the native production.

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THE NEW SCYLLA AND CHARYBDIS.

BY H. C. HOVEY.

Two pits of extraordinary magnitude have lately been discovered in Mammoth Cave, in such perilous proximity that risk is run of falling into the one while avoiding the other. Hence they have been aptly named "Scylla and Charybdis," in memory of the verse:

' Incidis in Scyllam cupiens vitare Charybdim."

Before giving an account of these particular pits it may be well to explain the formation of such cavities in general. The accompanying diagram (Fig. 1) shows a vertical section of an excavation made by the action of water on limestone —a process requiring an indefinitely long time, and proceeding at a varying rate corresponding to the abundance of the rainfall on the surface. The water, becoming acidulated as it sinks down through the soil, attacks the limestone along its lines of weakness. It thus holds in solution a portion of the rocky strata, in the form of carbonate of lime, and carries it away as it seeks the drainage level, A B. The result at first may be nothing more than an obscure fissure, leading from the sink-holes, S and S′, to the outlets, A and E, which, at a later period, become mouths of the completed cavern. As the crevice grows, the chemical action in which it began is aided mechanically by the quantities of sand and gravel swept in through the sinks, and that, being whirled about by the water, operate as a powerful cutting engine. The enlargements thus made are irregular in shape and frequently of great size.

Should the opening through the sink-hole be free from rubbish, the explorer will often find it the orifice of what he appropriately calls a *pit*. Should he gain admittance, however, by the drainage outlet, A, and follow the subterranean channel toward B, he will presently enter the chambers, C and D, and looking aloft to the vaulted roof, he will, with equal fitness, call them *domes*. But let him enter at E, the outlet of a former drainage, and come to a chasm capable perhaps of being bridged (as at F), he will say, as he alternately looks up and down, that a pit is below and a dome above. It may not occur to the explorer till long afterward that the pit, the dome, and the chasm are identical.

To this explanation it should be added, that, if the water has to make its way through a stratum of sandstone before reaching the cavernous limestone, the sink-holes and pits may not coincide; the former simply leading to crevices of no great depth, and the latter being connected with them by winding passages burrowed out between the two formations.

The thickness of what is geologically known as "the Saint Louis limestone," as it exists in Edmondson county, Ky., is between 600 and 700 feet, and it dips to the west at the rate of about ten feet to the mile. The exposed ledges everywhere show the results of erosion by acidulated water, and it is said that nearly every acre has its sink-hole, large or small. According to Prof. Shaler, there are about 500 open caverns in that single county. Many of these are capable of being entered directly from sink-holes; but it is a remarkable fact that, of all the hundreds of these depressions scattered over the area undermined by Mammoth Cave, not one is known to open directly into it! This I attribute to the overlying stratum of Chester sandstone, which resists the action of ordinary acids, although admitting the acidulated water through its seams and crevices, to do its work on the limestone below. In illustration of this, it is regarded as quite certain that the large sink-hole between the entrance to Mammoth Cave and White's Cave is drained through what has long been known as "Little Bat Avenue," in the former. Near the end of this avenue there is a small aperture into which, in 1812, a saltpeter miner dropped his lamp, and in his futile efforts to recover it found that it had gone down into a very deep pit. The incident was noted chiefly because the missing lamp could not be replaced short of Lexington. Messrs. Smith and Buford discovered "Mammoth Dome" in 1843, supposed to be the largest of all known domes. During their explorations they came across, greatly to their surprise, the miner's lamp that had been lost thirty-one years before, and that had been cemented to the floor by stalagmitic drippings!

Among the noted pits and domes in this extensive cavern may be mentioned "Napoleon's Dome," comparatively small, but remarkably symmetrical; "Lucy's Dome," estimated to be 300 feet high, though no means of taking an exact measurement have yet been found; and the "Maelstrom," the pit down whose frightful depths Prentice (son of the poet of that name) descended by a rope held by the guides. The rope was afterward measured and found to be 135 feet long. Most wonderful of all, however, is the cluster of pits and domes represented in the diagram, Fig. 2. In order to see them the visitor leaves the main cave at a point about three-quarters of a mile within, and passes around the huge block known as the "Giant's Coffin," and follows a winding way leading underneath the main cave.

The "Wooden Bowl" is a small room containing quantities of quartzose gravel, betraying the means by which these excavations were made. Next is the "Side-Saddle Pit," 65 feet deep, as measured by my guide, a colored man, William Garvin, who took along with him a ball of twine for such purposes. The opening is about 25 feet across. Over it, or nearly so, is "Minerva's Dome," 35 feet high. Descending a stairway, a short distance beyond, we enter the "Labyrinth," leading to "Gorin's Dome," formerly estimated to be 500 feet high. But the fact that recent barometrical observations fix the extreme vertical depth cut through the mass of limestone to reach the drainage level in Mammoth Cave at 328 feet, effectually disposes of all such exaggerated estimates. The aperture through which "Gorin's Dome" is seen by the visitor is a sort of window 90 feet above the floor of the dome. The latter can be gained by a side passage. In the floor is a small pit 15 feet deep, leading to a body of water 12 feet deep, making the depth from the window to the lowest point 117 feet. The height of the vault overhead seems to me to be about 100 feet; which gives 217 feet for the extreme altitude of this dome.

Fig. 1

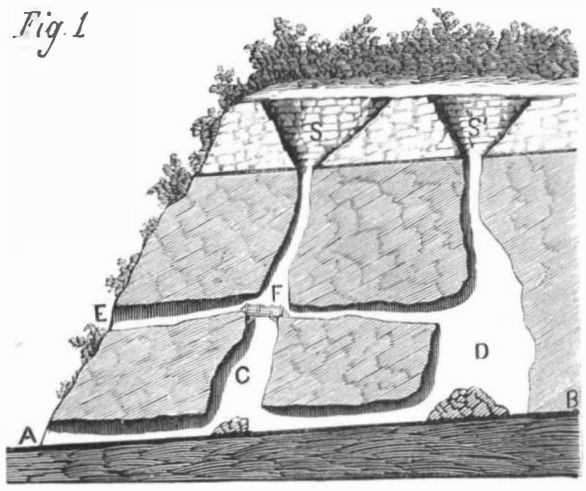


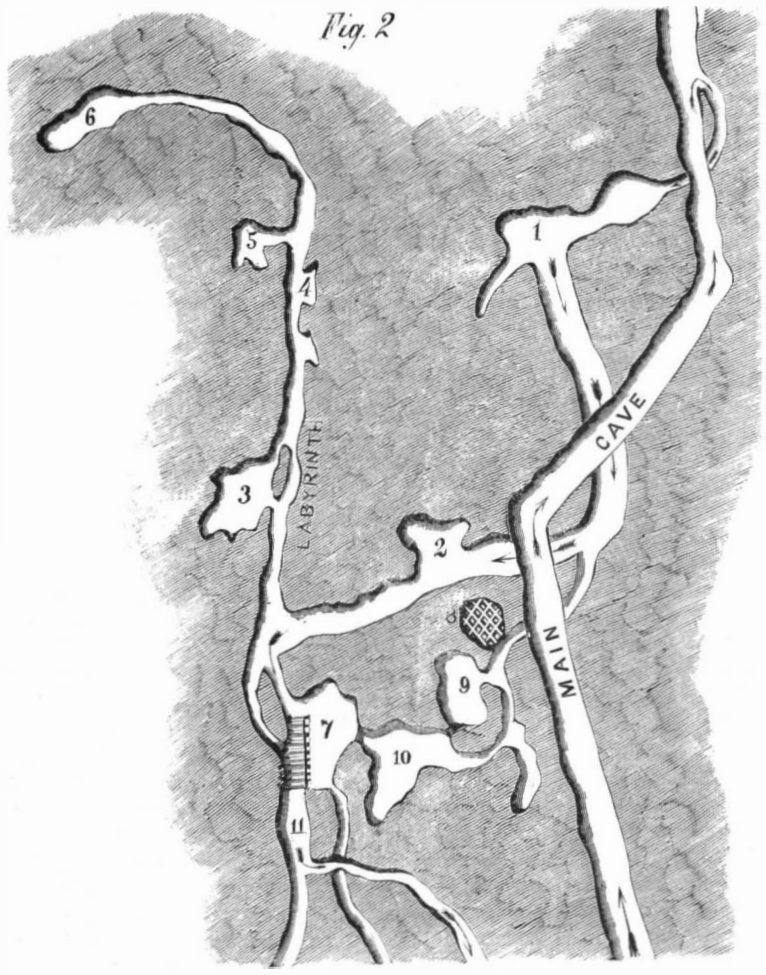
Fig. 1.—**VERTICAL SECTION.**

There are three or four small domes and pits beyond, indicated in the diagram merely because they belong to the group. One of these has been lately named in honor of Prof. F. W. Putnam, and the other for the writer of this communication.

Returning up the stairway leading out of the "Labyrinth," we next approach a famous chasm, known as the "Bottomless Pit," above which expands "Shelby's Dome." This was long considered an impassable barrier to further progress in the cave, but it is now crossed by a substantial bridge built to the further side from a tongue of rock that juts out into the pit for about 27 feet, seeming to divide the horse-shoe-like chasm into two pits. One of these pits is by exact measurement 95 feet deep, and the other 105 feet deep, although the guides have been accustomed to give much larger figures. "Shelby's Dome" may be about 60 feet high, the space between the pit and dome being 15 feet, thus making the greatest distance from top to bottom about 180 feet.

Most of the localities thus far mentioned have long been open to visitors; but it has been necessary to show their place in the cave, and their relation to each other, in order to an understanding of "Scylla" and "Charybdis," which were found only last winter by the guide, William Garvin, accompanied by Mr. C. T. Hill, and are not yet open to any except the most resolute cave hunters. Indeed I was told by the guide that I was the first visitor who had been permitted to explore this perilous place, though I learn that several have visited it since. The approach is by a low, creeping passage, opening from the arched way, and leading to what has been known—only to be shunned—for many years, namely, the "Covered Pit," a treacherous chasm, imperfectly covered by loose slabs of limestone, between which the black depths seem to be lying in wait for the explorer. After crawling on our hands and knees for some distance, we stopped, and William told me to listen to the slow dripping of water, and throwing a pebble through a low opening on the right, I could hear it bounding from side to side, and after long intervals falling into a body of water at a prodigious distance below. The guide was delighted at my expressions of horror, and repeated the experiment several times. He then challenged me to creep up to the edge and look down. In doing so we lay on a rocky bridge, with the old "Covered Pit" on our right, and the cavity since named "Scylla" on our left. The latter is really a pit within a pit, as we found on throwing lighted rolls of oiled paper down its mouth. The upper pit seemed to be about 90 feet deep, and at its bottom we could just discern the orifice of the lower one. I was anxious to find a point from which we could examine this inner pit to better advantage. Creeping back from off the bridge, and then onward around a rocky pillar, for perhaps forty yards, we came upon the further edge of Scylla, and also found another horrible pit on the left, which, in pursuance of a suggestion from Mr. Klett, the manager of the cave, we named "Charybdis." The dividing ridge at this point was only about six feet wide, between the two chasms, and the classical names chosen seemed to us quite appropriate. Willing to run some risk in pursuit of my object, I clambered a short distance down into "Scylla," to a ledge overhanging its very deepest portion, and cleft by a serpentine crevice about five inches wide. Dropping pebbles through this crack, we could easily time them as they fell, unobstructed, to the bottom of the lowest pit. By repeated trials we determined the time to be exactly five seconds by the watch. This, by a well known formula for calculating accelerated motion, would give 402 feet as the depth *in vacuo*. Making due allowance for the resistance of the atmosphere, and also for the time necessary for the return of the sound, the space passed by the falling pebble was not less than 200 feet, nor more than 250 feet. William, not satisfied with what he may have regarded as scientific guess-work, produced his ball of cord, fastened a lamp to the end of it, and let it down into the darkness. The glimmering light served to show the irregular walls of the abyss, as it descended, until at length it caught on a projecting rock. In his efforts to shake it loose, the guide was so unfortunate as to burn the cord off. The lamp, however, remained where it had lodged, shining on as if determined to do its duty to the last! The part of the cord that was drawn up measured 135 feet, leaving us, after all, to conjecture the remaining depth, our conclusion being that the previous calculation had been near the truth. Probably the limestone is pierced to the drainage level—a distance, according to the barometer, as inspected in the "Arched Way," of about 220 feet.

Fig. 2



1. Wooden Bowl.—2. Side-Saddle Pit.—3. Gorin's Dome.—4. Putnam's Cabinet.—5. Hovey's Cabinet.—6. Ariadne's Grotto.—7. Bottomless Pit.—8. Covered Pit.—9. Scylla.—10. Charybdis.—11. Revelers' Hall.

Fig. 2.—**PLAN OF A PART OF MAMMOTH CAVE.**

Glad to forsake the thin crust on which we stood, overhanging such depths, we climbed out of the jaws of "Scylla," and made experiments on the depth of "Charybdis." Here again the fragments of stone cast down were five seconds in reaching the pool below. Along the perilous rim William led the way to still another chasm, which he identified as the "Bottomless Pit." Regaining with some difficulty the bridge over it, we proceeded for a short distance on the path that leads to "River Hall," and then turned back by a passage leading under the rocks to an opening in the wall of the "Bottomless Pit," about forty feet below the bridge. Here we saw the famous pit in a new light, and also obtained the only good view to be had of "Shelby's Dome" overhead. While we were standing there I noticed a volume of smoke issuing from a window beyond us. On investigating this phenomenon more closely, we found ourselves looking again into "Charybdis," though not at its deepest part. The smoke came from blue lights we had ignited just before leaving it. On mentioning this fact to Mr. Klett, I was informed by him that he had, on a former occasion, been burning lights in the new pits, and workmen on the bridge had seen them.

Thus, as we have shown, there are, within an area whose diameter does not exceed 600 yards, and may be considerably less than that, six of the largest naturally-formed pits in the known world, besides several others of smaller dimensions; and the entire group is joined together by connecting passages.

On inquiring if there was any sink hole in the vicinity to correspond with such a cluster of chasms, I was directed to

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a piece of unbroken forest, less than half a mile from the Mammoth Cave Hotel, where all the requirements of the case seem to be met. This vast depression embraces many acres, and is so deep that, when standing on its edge, one can overlook the tops of the trees growing in the central portion. But it remains to be proved by further exploration whether there are any hidden channels communicating, directly or otherwise, with the remarkable group of domes and pits I have attempted to describe in this article.

AMERICAN INDUSTRIES.—No. 78.

INDUSTRIAL PROGRESS AS REPRESENTED AT THE FIFTIETH EXHIBITION OF THE AMERICAN INSTITUTE.

The popularity of the now constantly recurring fairs in different sections of the country, showing the advancement we are making in the arts and sciences, in mechanics, chemistry, and our multitudinous manufactures, seems to be in no way diminished by their frequency. They are, on the contrary, at once the index and exponent of the activity, enterprise, skill, and inventive genius which are so characteristic of American progress to-day, so that the public is in entire harmony with the spirit they represent, and heartily inclined for a ready appreciation of all which contributes to their interest.

The semi-centennial exhibition of the American Institute, now being held in this city, extends and rounds out what had heretofore been a long and most valuable record of the growth of our manufactures, and the contributions of American inventors and mechanics in furtherance of the march of improvement in all the arts and sciences. It is worthy of its predecessors in all that goes to make such an exhibition not only attractive to mere sightseers, but valuable as an educator, in the means it affords of bringing the public more heartily into sympathy with the spirit of modern scientific investigation, and rendering observers more appreciative of the high degree of excellence which is being reached in all industrial pursuits.

It would be impossible, within the limits of a single article, to make even the briefest allusion to all of the exhibits here shown that are deserving of attentive examination. In the machinery department every inch of space is occupied, and some of the engines working here are models of beauty and symmetry, doing their work so smoothly and noiselessly that one would hardly know they were running were it not from the motion of the belts and shafts and the machines operated. The most interesting exhibit in this department, and one which constantly attracts crowds of visitors, is that of the Brush electric light system, the operation of which, and its thorough efficiency, with a pretty accurate idea of the consumption of power, and the inconsiderable wear and tear, can be readily understood by any visitor with the least possible idea of machinery. Of the light itself it is scarcely necessary to speak, all parts of the exhibition being made as bright as though sunlight were streaming in at every window when all of the ninety-six lamps are burning, while half of them make the gas lights look as insignificant as the old-fashioned "tallow dips."

On the first page of this paper we present illustrations of some of the prominent exhibits at the fair. The display of the New York Belting and Packing Company, shown in the large view at the bottom of the page, bears a sign in large letters, with the legend

"RUBBER VS. LEATHER."

It is on the left, as the visitor proceeds from the main aisle of the exhibition building to the machinery annex, where it cannot fail to meet the eyes of all who use belting, and under the sign is inscribed the statement that it would require "one thousand ox hides" to furnish leather sufficient to manufacture the large belts shown. One could readily figure out this for himself by taking the surface measurement and allowing for only the portions of a hide usually taken by leather belt manufacturers, but here would come in the fact that many of the leather belt manufacturers use more of the inferior parts than others, and the further fact that, no two hides being exactly alike, and no one hide being of the same strength or substance in different portions, it would probably trouble the investigator with a mathematical turn of mind as much as it does the leather belt manufacturers themselves, to tell just what selections and measurements to make to obtain even strength and substance in any large belt.

All of this difficulty is avoided in the manufacture of rubber belts, which are sure to be homogeneous throughout, and never before has there been a better display of what it is possible to accomplish in the making of rubber belting than is afforded in this exhibit.

The New York Belting and Packing Company have for many years made this manufacture a leading feature of their business and introduced improvements of the highest value. The great strength of the rubber-coated and impregnated duck used in their belts insures them against any break from a tensile pull twice or three times as great as the best leather will stand; the "stretch" is also taken out completely, the belts being subjected, while under tension, to the action of a powerful hydraulic press, one of the largest of the kind in the world, the bed and platen of which are steam heated, so that the fibers, thus compressed between the hot plates, are set almost as firmly as the particles in a bar of steel; the edges of the belts are firm and smooth, there being practically no joints, and, by a long course of improvements in the composition, they have a hard and tough, almost metallic, surface, but still one of such a nature that these belts always hug the pulley more closely than leather belts.

The contest as to the relative value and efficiency of rubber against leather belts is an old one, but it is one which mechanics and millowners are always interested in, and only those who have seen and used rubber belts of the best quality are qualified to form a correct judgment, for, although there has been a great improvement in the manufacture within a few years, there are still made large quantities of rubber belts of a cheap and inferior quality. In connection with the belting shown in this exhibit are furnished testimonials from some of the prominent users, including many of the great elevator companies, who use the largest sized belts known. These show that in some instances the belts have been used twelve and fifteen years, "without costing a dollar for repair, and still in as good condition as when first set to work." This the company think quite as good a record as can be produced in favor of any leather belting made, notwithstanding the fact that a newspaper in the interest of leather dealers a few months ago quoted as follows from the pamphlet of a leather belt manufacturer: "Buying a rubber, gutta percha, or canvas belt is very much like buying a sickly horse at 33⅓ per cent less than a good healthy one would cost. If such a horse is well groomed, used carefully, left in the stable when sick—when the weather is hot, when cold, when stormy—he may live six months; with extreme care and good luck, one may be able to say that he owns a horse for twelve or eighteen months. Pay 33⅓ per cent more and buy a good healthy one, use him well and kindly, he is always at your service, and can be depended upon. After being in use twelve or fifteen years, he is still good. and, if sold, will bring 33⅓ per cent of his cost. A word to the wise is sufficient." This seems to be a case where the saying that "one story is good until another is told," is particularly in point, and, as the exhibits of both kinds of belting are excellent, those interested will do well to examine for themselves.

Of the other productions of the company, the various kinds of packing, hose, valves, car and wagon springs, mats, gas tubing, etc., make a most interesting display to all who desire to utilize vulcanized rubber fabrics for mechanical purposes. The knot of bicycle tires shown is likewise suggestive, not only of the rapid increase of the demand for these novel steeds, but also of many other uses to which this principle might be applied in rendering cars and other vehicles noiseless and increasing their traction.

The exhibit of Vulcanite Emery Wheels covers a full line of sizes, and embraces the leading grades for fine or coarse work. Only the genuine Wellington Mills emery is used in the manufacture of these wheels, and the company believe they have now attained very near perfection in their production. Every detail as to the best possible constituents for the composition which shall closely bind the emery, the degree of heat and time required for vulcanization, and the mechanical appliances best fitted for the necessary operations, were the subject of prolonged and costly experiments, and the success they have attained is best attested by the large demand for their wheels both at home and abroad. Only just enough rubber is used in their manufacture to bind the emery closely, but they are sufficiently strong to be run at a circumferential velocity of 5,000 to 7,000 feet per minute, and wear evenly, without glazing. Many as are the uses for which emery wheels have been employed in late years, there is hardly a week but develops some new work for them in our factories and machine shops, and a uniform as well as high quality has now become quite as important in this specialty as it is in any other part of the outfit of an artisan.

THE NEW PULSOMETER STEAM PUMP.

An illustration showing this exhibit at the Fair may be seen at the top of the page, to the left. The improvements made in this pump, since which it has been designated as the "new" pulsometer, have caused a widely extended demand, and are bringing to the company encomiums of the most valuable character from all parts of the country from users in almost every department of industry. The variety of pumps now in the market is almost endless, but the new pulsometer is this year on exhibition at all the leading fairs, in competition with those of every other description. At the Fair of the Massachusetts Charitable Mechanic Association, in Boston, where a leading feature is made of the working of pumps for a variety of fountains and large reservoirs, this pump was especially designated by the management to do a portion of the daily work that could not be dispensed with, on account of the comparatively small quantity of steam it required, where other pumps made too large a drain upon the boilers. With this efficiency it combines great strength and durability, it being so simple in construction as to be almost impossible for it to get out of order.

The quickness with which this pump may be set up and put in operation in any locality is, aside from the great amount of work it will do, one of its most valuable recommendations. It is connected at the top with a steam supply pipe, and at the bottom with the suction pipe, the discharge pipe leading from the discharge chamber. It works with a vacuum and with direct steam pressure in two chambers alternately, the operation being so nicely regulated by a well-fitting ball valve that the pumping proceeds steadily and almost noiselessly, like the regular beating of a pulse, from which the pump has its name and registered trademark. In working, the steam enters the chamber directly above the water, pressing upon and forcing it out through the discharge valve with a force proportionate to the steam pressure; when the water has been displaced by the steam, which follows it to the opening of the discharge chamber, the steam suddenly condenses, leaving a vacuum, which is at once filled from the suction pipe.

Among the striking testimonials which the company have this year received as to the efficiency of their pump was one which came from the Michigan Coal Company, who had a "cave-in" at their mine at Jackson, in that State. The shaft was 85 feet deep, and the water on four to five acres at the bottom was said to average five feet in depth; they testify that the water was lowered by a No. 9 pulsometer pump at the rate of twenty-three inches per hour. Numerous other testimonials are also furnished showing their efficiency for mining, railroad, and steamboat use, for all kinds of manufactures, for draining quarries and cellars, and for irrigation, and in Europe as well as in this country.

These pumps are made of brass or other metal for pumping liquids destructive to iron, with lead for acids, bronze for sugar works, and special composition or wood valves for other purposes. They are manufactured and sold by the Pulsometer Steam Pump Company, 83 John street, New York, Wm. F. Kidder being president of the company, G. F. Badger, secretary, and Geo. W. Laird, treasurer.

ASBESTOS PRODUCTS FOR ROOFING, BOILER AND PIPE COVERINGS, PACKING, PAINTS, ETC.

One of the first exhibits to attract the eye, at the right as you enter, is that of the H. W. Johns Manufacturing Company, which we illustrate in one of the views at the top of the page. Here are arranged a selection of their varied productions, including asbestos roofing, boiler coverings, lining felt, steam rope wick, and flat packing, millboard, gaskets, sheathings, cements, etc., with their liquid paints in a great variety of packages. The display is a more tasteful one than it would be supposed could be readily made from this homely yet highly utilitarian product, and cannot fail to interest millowners and steam users generally, as well as those who study economy and good service in either interior or exterior painting.

The variety of purposes for which asbestos has been made available within the comparatively few years since its valuable properties have become known, and practicable methods of working it perfected, would be somewhat remarkable, were it not simply a repetition of our experience in the uses so rapidly found for other natural products when skill and inventive genius first adapt them to meeting acknowledged wants of the public. This silk-like and really fine-fibered mineral has, through the agency of Mr. Johns himself, who first commenced its utilization in 1858, become a most invaluable agent for many mechanical purposes, besides meeting a multitude of wants of architects and builders in a way that at once increases the durability and lessens the cost in a great variety of structures. In its use for roofing, for instance, for which it was first adapted, its great economy over the expensive materials previously thought necessary, while it at the same time made a tight roof needing but little repair after years of wear, at once gave it an extensive demand. The appearance of these goods is familiar to all, it being furnished in rolls about forty inches wide, of any desired length, so as to make a light covering, and one very quickly put on; it consists of a manila lining, upon which is a layer of waterproof composition, then a strong canvas, another layer of waterproof composition, and a surface layer of asbestos coated felt. In connection with this roofing fabric, an asbestos roof coating is also manufactured for prolonging the service and keeping the roof in good order, also a white fireproof coating, which makes the roof air and water tight, forming an effective non-conductor for protection against fire from adjoining buildings.

In the paints, which form a conspicuous portion of the exhibit, besides the asbestos fireproof paints and coatings are a full line of fine linseed oil paints, in liquid form, the company designating their productions in this line, which have now become very extensive, with the well known trademark which distinguishes all their goods. These paints are ground and mixed differently from the processes usually followed, and are not intended to compete in price with cheap goods in this line, but are claimed to have superior durability, and therefore more economical to the consumer, than white lead and other paints in common use. For roof painting the company have a special preparation, which, either alone or in combination with their asbestos cement, they recommend for rough usage and in exposed situations, and also for the preservation and repair of old leaky tin and other roofs.

The styles of coverings for hot air and steam pipes, boilers, etc., preventing the radiation of heat and economizing fuel, are shown in great variety. The company have patents on many different combinations and ways of using asbestos for this purpose, but for pipe coverings they recommend their asbestos lining felt—a pure asbestos sheathing, to one side of which is attached "flocked" asbestos. This comes in sheets and rolls, and makes an insulating cushion or non-conducting lining, over which is placed a layer of hair felt and then one of non-porous fireproof sheathing. For boiler coverings, or where large surfaces are to be protected, the company recommend a special production called asbestos cement felting, partaking of the nature of a felt and a cement. There is sufficient strength and flexibility to the asbestos fiber to prevent the cracking of such a covering from the expansion and contraction of boilers due to varia-

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ble degrees of heat, and its indestructible nature gives it great permanence.

Besides the above, there are numerous other productions in the exhibit into which asbestos enters more or less largely, and a great variety of specimens of the natural asbestos, but it is difficult to make the common run of visitors believe these goods are manufactured from such a natural product. A great deal of attention is given to a little illustration in the exhibit showing the indestructibility of asbestos by heat, an Argand gas jet being kept constantly burning, over which is fixed a handful of asbestos fiber, but the hot flame is seen to have no effect whatever on it, a result which surprises not a few of those who take these fine textured shreds to be of silk or some such fiber.

Mr. Johns is the inventor and patentee of the methods and processes by which all the products here exhibited are manufactured, being the originator in the application of asbestos for these modern uses, and for its combination and employment in every way heretofore found practicable. The New York office of the company is at No. 87 Maiden Lane, where illustrated catalogues, descriptive of their inventions, can be obtained, and their goods are sold by dealers in all the principal cities and towns in this country and abroad.

THE ALMOND COUPLING,

an interesting mechanical device, which attracts much attention, is shown in one of the small views. It furnishes a substitute for bevel gears and the quarter turn belt to allow of shafting to be run in any desired direction.

GAS STOVES

are shown in great variety at the exhibition, by manufacturers of stoves, meters, and heating apparatus generally, and our artist gives a sketch of one of the most noticeable of these, showing how to "put the kettle on," etc.

STEAM BOILER NOTES.

The London *Iron Trade Exchange* has the prospectus of a new steam boiler insurance company, incorporated under the name of the Scottish Boiler Insurance and Engine Inspection Company. The liability of shareholders is limited to the number of shares held by them. Their principal office is to be at Glasgow; their capital, £50,000, in 10,000 shares. Subscribers are required to pay five shillings per share on application, five on allotment, and ten shillings at the expiration of three months from the registration of the company. The other £4 are not to be called for, but remain a reserve fund for the security of insurers. It shows that steam boiler insurance is profitable, by quoting from the "Stock Exchange Year Book," the business of three other stock companies in England, none of which have ever been called on for their reserve, which is about the same percentage of the par value as that proposed by the new company, while their dividends have been from ten to twenty per cent per annum, with occasional bonuses varying from two to five shillings per share. It claims that there are in Scotland about 25,000 boilers, and only 9,000 to 11,000 of them insured. The *Trade Exchange* says:

"The business of the company is to insure boilers against explosion or collapse, and the periodical inspection of both engines and boilers, the testing of new boilers by hydraulic pressure, the superintendence of the erection of new engines, and the repairs of those in use, also to advise policyholders generally in matters relating to their engines and boilers. The system of boiler insurance and inspection inaugurated by a Manchester company, eight years since, has been eminently successful. It met the need of steam-power users of competent periodical inspection of their boilers without entailing great expense. By the system of boiler insurance the steam-power user is relieved of all anxiety as to the condition of his boilers; he could not effect a policy unless the plant was in safe working order, and, the policy once effected, the insurance company will, by careful and periodical inspection, see that the condition of the boilers is kept up. The destruction of life is rightly the most dreaded calamity in connection with a boiler explosion, and we feel satisfied that the Manchester Boiler Insurance Company, the Wolverhampton Company, and others have been the means of saving many lives by their insurance inspections. The Scottish Boiler Insurance and Engine Inspection Company is founded to insure and inspect boilers in Scotland, and, looking at the immense number of steam-power users north of the Tweed, there is certainly a wide and useful field for its business."

The boiler of a train on the Hastings and Dakota division on the M. and St. Paul Railway exploded, September 26, near Prior Lake, while running fifteen miles an hour. The engine was thrown 150 feet forward and off the track, two cars being derailed. Engineer Grove Bradbury was thrown a considerable distance and died soon after. The fireman and conductor Jones were slightly injured. No passengers were hurt, and they were sent to their destination on a special train.

Under the provisions of the new boiler inspection ordinance of Detroit, Mich., which has already gone into effect, all persons desiring a license must file an application with the inspector, William Wray, stating their experience and qualifications, and having the indorsement of at least two well-known citizens as to their temperate habits and good character. The inspector will then examine the applicants as to their qualifications, and report the names of such persons as he deems competent to the mayor, who will issue the license when the necessary bond is executed and the stipulated fees paid into the city treasury.

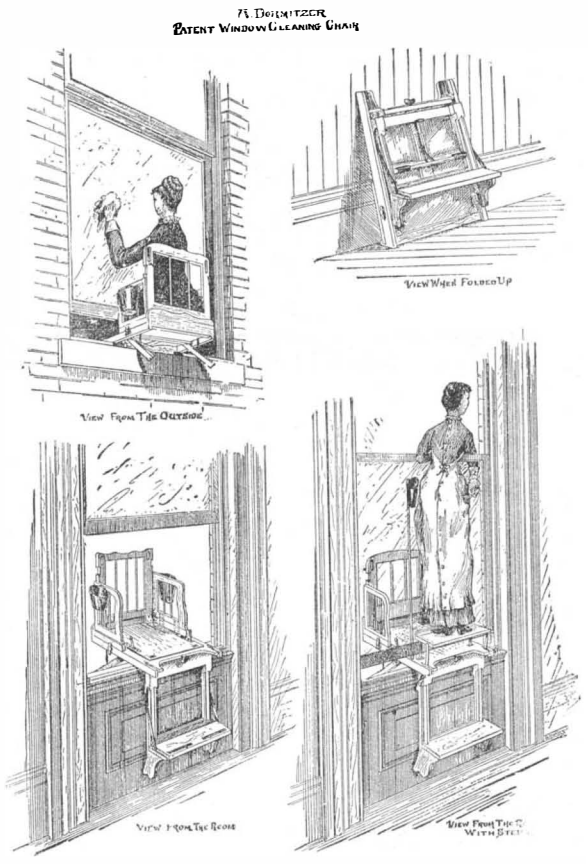
By the explosion of a boiler, late in September, near Uniontown, Pa., James McDonough was fatally scalded and four others injured. The cause was the use of sulphur water during the drought. This cause of boiler explosions has been before alleged, and was commented on in these notes under date of October 1. It is probable sulphur had less to do with the explosion than the announcement of its use seems to indicate.

The St. Louis *Age of Steel* says: "A Canadian mechanical engineer named Arnoldi has invented a device designed to give a partial security against boiler explosions. The invention consists of an electric adjustable attachment to the ordinary steam gauge now in use, to give an instant and continuous alarm, at any distance from the boilers or other pressure generators, of any excess of pressure over that at which the alarm has been set, and where there is more than one generator in operation, an ordinary 'tell-tale' can be attached to signify which generator is at fault. The invention possesses a great many valuable features, prominent among which may be noticed that it is extremely simple and inexpensive, and can be attached to existing arrangements at no expense beyond that of the alarm itself, and without in anyway affecting the present adjustment of the gauge."

This apparatus might be made very useful if placed beyond the reach of the boiler attendant, and connected by wire with the residence of the superintendent or owner of the boiler. It would, at night especially, tend to keep a watchman on the alert who might otherwise coal up the fires for a good rest, go to take a smoke or a nap when he should be attending to his duties. It would be an easy matter, however, for a rogue to disconnect the wire and thus defeat the object of the device.

IMPROVED WINDOW CHAIR.

The many accidents to life and limb of persons engaged in window cleaning or doing other work about the windows of our high dwellings calls for a safe support for persons



NEW WINDOW CHAIR.

doing such work. The patent window-cleaning chair, shown in the engraving, is designed to supply this want. It not only affords a safe and comfortable seat for females who are often obliged to risk their necks at this work, but it is also a strong and safe platform for men to stand on to paint, glaze, put up awnings or decorations, or do other work about windows. It holds cups for the necessary water and cloths to clean with. It is provided with supports for paint and brushes, and it will be found very desirable to those who wish to work quickly and safely, as well as a protection and safeguard to those who are timid and nervous while working in elevated places. The window chair is fastened and detached in less than a minute, and, in addition to the uses already mentioned, it will be found very agreeable to sit upon when it is desirable to obtain a breath of fresh outside air; sitting on it comfortably the cool breeze can be enjoyed without leaving the room. The construction of the chair is very simple, and so light that a child can carry it. It folds up like a book and stores away in a very small space. It will fit any ordinary sized window, and is provided with a step which permits of reaching the highest parts of the window, and the work of cleaning can be done without the aid of a step ladder. The window-cleaning chair can be seen at the Inventors' Institute, corner of Third and Fourth Avenues, Seventh and Eighth streets.

Oysters in New Orleans.

The coast of Louisiana abounds in oyster banks, and a considerable oyster trade has been developed at New Orleans, giving employment to about 200 luggers, each manned by from three to six men. The owner is usually captain, and receives two shares of the net proceeds of the sale of the oysters, one being claimed by the boat and one for himself. Every man on board then receives a share each in payment for his services, from which he has to pay his board or for his share of the expense incurred in the purchase of provisions. A trip usually consumes from four to seven days.

The oysters are taken by tonging. During the summer and early fall the supply is for the most part the small and watery "raccoon" or basin oysters, from Saline Bay, Grand Isle, and Barataria Bay. The price ranges from $1.25 to $3.00 a barrel. A better quality is received later from Bayou Cook. These oysters have been transplanted during the summer from Saline Bay and natural beds elsewhere, and are fatter and better flavored than the natives. Bayou Cook oysters fetch from $2.50 to $4.00 a barrel. Owing to the shortness of the orange crop this year a large number of fruit luggers will be transferred to the oyster traffic. The wholesale oyster houses in New Orleans give employment to upwards of 500 hands.

Gold in New York.

The Albany correspondent of the *World* finds that 757 persons have filed claims for 597 localities in the State of New York said to contain gold and silver. Some of these claims are explained by the fact that, to forestall other possible claimants, the owners of lands have filed claims for mineral veins, or suspected veins, without much regard for their intrinsic value. Most of the claimants, however, appear to believe that their discoveries are important; and it would also seem that, to a considerable extent, the claimants are not very well qualified to judge of the probable character and value of mineral deposits.

The correspondent cites a number of claims to illustrate the extraordinary ignorance of metallurgy shown by some of the would be miners. One locator claims the possession of a ledge yielding gold, silver, platinum, iron, tin, lead, and graphite—truly a curious, not to say wonderful, conglomeration. Another says that his claim is one-fourth pure silver—rich ore, as any Western man would tell him. And yet another locator states that his ledges, of which he has thirteen, contain gold as good as that placed upon Solomon's temple. He says, however, with exceeding *naveté*, "I have not found any yet."

The position of the claims shows four well defined gold fields. The first begins somewhat about Plattsburg, and runs in a southerly direction into the counties of Hamilton, Fulton, and Saratoga. It then divides into two branches, going west into Herkimer and east into Washington County. The second is south of this, in the neighborhood of Dutchess County. The third is still further, south in Westchester and Rockland counties. The fourth is in the western part of the State, in Erie and Allegany counties. From the fact that the Geological Survey has not yet made any examination of these alleged gold fields, it can only be said in a general way that quartz is known to exist in the neighborhoods where these gold and silver veins are said to be. It is therefore impossible, without examination, to say how much basis there is for the faith shown by the locators. In a few instances the notices filed in the office of the Secretary of State contain statements of assays made and work done, but these are not enough to found a judgment upon as to whether these gold fields will commercially pay. They simply indicate that the locators have, in some instances, proved their faith by their works. One of them records the discovery of a blind lead, or lead of which there were no surface indications of gold, while sinking a shaft on a silver-vein. As the gold lead was discovered at a depth of fifty odd feet, the notice shows some considerable work done.

The Largest Elevator in the World.

The new elevator built by David Dows & Co., in Brooklyn, is said to be the largest in the country, and probably the largest in the world. It has 100 feet front upon Columbia street, and extends thence 1,200 feet to the river, 600 feet being occupied by the main building, which is of brick, and 600 feet by a frame extension, which is sheathed with tin. The frame building is 45 feet high, and has a tower in its center 100 feet high from the wharf level. The brick building is 85 feet high, and has an elevator tower in the northeast portion 120 feet high. Three towers rise from the center line of the main building, about 100 feet from each other. Each tower is 175 feet high. Solid brick walls divide the main building into nine apartments, closed to each other, except where there are openings for the belting to pass through. These walls form a bulwark against fire, as the holes can be closed by dropping a cast iron door over them, and if the fire should be so fierce as to cut off access to these doors they are so arranged that the ropes may be burned quickly, thus permitting them to drop of their own weight. An electric fire and burglar alarm is furnished for the building.

The machinery in the elevator can take grain at the rate of 8,000 bushels an hour from the barges or vessels at the pier. The grain is elevated, sifted and fanned, weighed, stored, put in bins, and then transferred to vessels at the pier. There is nearly a mile of wire cable used to transfer the steam power, and about five miles of belting, called conveyers, carry the grain up with railroad speed. These conveyers travel at the rate of 600 feet a minute, and carry to its destination 2⅓ bushels of grain a minute. No shoveling is necessary.

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NEW INVENTIONS.

Mr. Lester Low, of Ryegate, Vt., has patented an improvement in carpenter's squares, which consists, first, of a square provided with crenelations or notches along one or more of its edges, arranged to coincide with its graduations.

Mr. Randolph P. Cory, of Union City, Ind., has patented an improvement in that class of revolving firearms in which a chambered cylinder is adapted to slide as well as revolve on a horizontal axis and is forced up against the barrel just previous to each discharge.

Mr. George T. Hedrick, of Weaverton, Ky., has patented an improvement in bag stoppers, which consists of a short solid cylinder or disk, externally flanged at top and bottom, with a central circular groove between the flanges, to receive the upper end of the bag and its drawing string, the lower flange being provided with two or more holes for attaching one side of the stopper to the bag, so as to be swung outside of the bag and out of the way of the grain in filling a bag or emptying it.

Mr. George Cressey, of 175 Third St., Louisville, Ky., has patented an electric water meter register. The object of this invention is to provide a practical and reliable means for registering the amount of water passed through a meter. The invention consists, principally, in combining an electro-magnetic register, a battery, and a circuit wire with a water meter, which circuit wire enters the meter, and through proper insulations and contact faces makes and breaks the current at every impulse of the piston or other working part of the meter without the necessity for a stem or any other movable part operating through the meter case

IMPROVED GOVERNOR.

We give an engraving of an improved governor recently patented by Mr. Joseph H. Stombs, of La Crosse, Wis. This governor is of the class in which an auxiliary weight is used in connection with the customary governor balls, the weight engaging with the stem of the governor valve and serving as a means for controlling the action of the valve, to make it more sensitive.

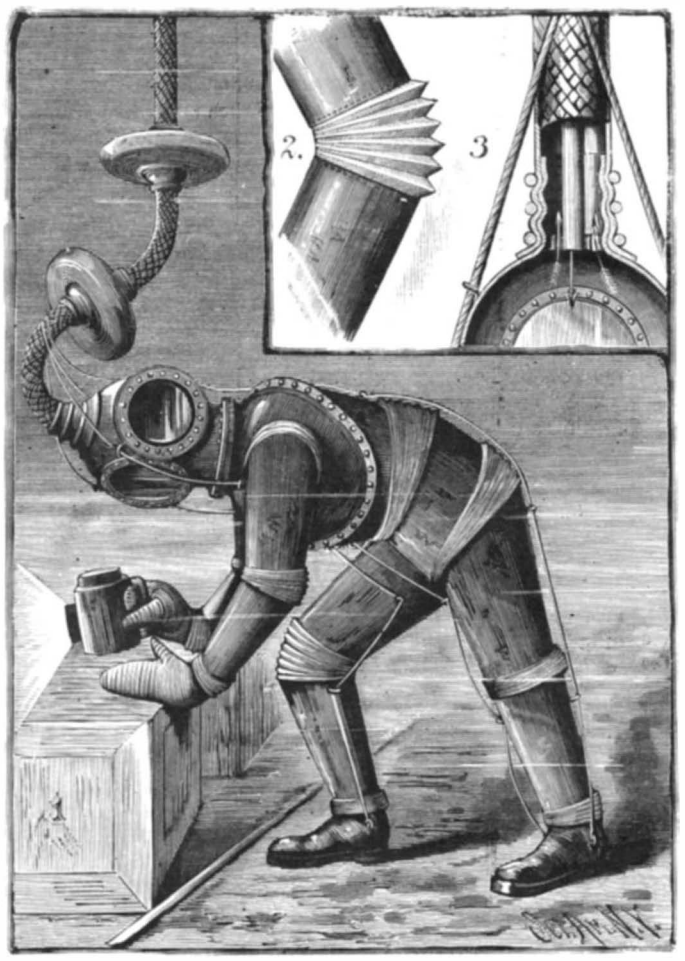
The improvement consists in a cylindrical shell of glass provided with detachable heads having a central tube, which passes through the cylindrical shell and receives the stem or long arm of a lever fulcrumed in a block or support carried by the base plate of the governor frame. The cylinder is movable on the lever, and is half filled with a suitable liquid. The short arm of the lever engages the valve stem The lever rests upon a knife-edged fulcrum.

The governor stem carries the customary bevel wheel, into which meshes a bevel wheel on the governor driving shaft. The stem is loosely fitted in an encircling sleeve, which receives the inner ends of the arms carrying the governor balls.

A collar secured to the stem below the sleeve serves to form a temporary connection between the governor balls and the valve stem when said balls are thrown in an outward direction by centrifugal force, tending to close the valve. The governor stem is surmounted by a ball, which causes the stem to slide through the frame and bevel wheel when the governor balls drop by reason of the breakage or stoppage of the driving mechanism. It necessarily follows that the downward movement of the stem facilitated by the weight will cause the governor valve to close and instantaneously arrest the flow of steam to the engine.

The sleeve below the bevel wheel, which connects the valve rod with the governor stem, has a transverse pin carrying wedge-shaped blocks at its ends. The face of the sleeve adjoining the end of the weight lever has a recess, which forms a seat for the wedge-shaped block.

It will be apparent that when the thin end of the block is turned in a downward direction the end of the weight lever will remain engaged therewith during the ordinary movements of the governor balls; but when the latter have assumed their lowest position the end of the lever will glide off from the block, so as to disengage it from the valve and governor stems, which will permit the valve to close by means of the independently movable governor stem. By placing the thick edge of the block down, the parts are so set that the lever cannot become disengaged from the valve and governor stems. The lever is only to be used in this last described manner when the motor is being "shut down." When the stop motion is on, which is the case when the thin end of the wedge-shaped block faces in a downward direction, the regulator or weighted lever will be unshipped in the manner already described, and in dropping down it falls upon a spring, which breaks the fall of said lever. In the ordinary working of the governor the center of gravity of the weighted lever is shifted with every upward and downward movement of the lever, making the governor more sensitive than it could be with a fixed weight on the lever.



STOMBS' GOVERNOR.

NEW DIVING APPARATUS.

In diving apparatus shaped to the human body it has been difficult to combine with the requisite flexibility of material a rigidity sufficient to resist at every portion of the armor the external pressure of the water without re-enforcing or aiding the material of which the apparatus is composed by pumping within it a supply of atmospheric air not only sufficient to insure life to the diver, but also sufficient to balance the external pressure of the water.

The armor, shown in the engraving, overcomes this difficulty, and is of itself of sufficient strength to resist at its every portion the external pressures without re-enforcement by an oversupply of internal air, and is at the same time sufficiently flexible to permit of the movement of the diver.

TASKER'S IMPROVED DIVING APPARATUS.

The flexible waterproof covering of the armor is made of rubber, water-proof cloth, or other fabric, which, while both strong and elastic, is impervious to water.

An interior metallic casing constitutes the inner layer, or body of the suit. The lining has rigidity sufficient to retain the contour of its various sections against the collapsing pressure of the water.

The joints corresponding to the joints of the limbs are of bellows form, permitting of the free movement of the body and limbs. The joints are stayed so as to prevent collapse from external pressure, as shown in the sectional view, Fig. 2.

It is obvious that this joint has the advantage of being laterally very stiff, compact, and light, a few rings cut from light sheet metal insuring, from their form and arrangement, both strong resistance to exterior pressures and large extension to the flaps. The flap portions are thoroughly protected by the rings when closed, and held with certainty in their folds, while the connection of section with section is steady and strong, whether the joint be open or shut. The apparatus, therefore, considered as a whole, is a casing at all parts, joints, and unjointed surfaces, capable of resisting external pressures.

The trunk portion of the apparatus is provided with a coupling, which starts from one shoulder, extends obliquely around the body, front and back, and terminates below the arm which is opposite to the shoulder mentioned, so that the apparatus can be easily put on and taken off.

The helmet of the apparatus, shown in section in Fig. 3, is adapted to be removed.

The air tubes consist of an inner tube for supplying air, and an outer tube for carrying off the exhaled air. These tubes are made to resist a high degree of external pressure and to have a tensile strength sufficient for raising and lowering the apparatus.

This new diving apparatus is the invention of Mr. Stephen P. M. Tasker, of Philadelphia, Pa.

Charles A. Spencer.

For many years the little town of Canastota, N. Y., has been known to scientific men the world over as the source of the most perfect and efficient microscopic lenses to be found. Their maker, Charles A. Spencer, died recently, at the age of sixty-eight, in Geneva, N. Y., whither he removed five or six years ago. With all his genius and skill, Mr. Spencer had none of the traits of a money-maker, and his whole life was troubled by poverty due very largely to his inability to carry on a business by business methods. His great difficulty apparently was that he never reconciled himself to the idea of spending his life as a mechanic, though in his sphere the best mechanic in the world, and so devoted to classical and other studies time that should have been devoted to the business interests of a calling for which he was pre eminently adapted.

An intimate friend says of him in a communication to the Utica *Herald:* "At an early day he acquired a reputation which opened the broadest market for his glasses and instruments, but the trouble was his tardiness in filling orders. He would suffer none to go from his shop until tested by him and found perfect, and to do this he would take time, and that discouraged patrons. I have been shown by Mr. Spencer unfilled orders on hand at one time, from all parts of the country and from Europe, amounting to from $20,000 to $25,000, or more. One of the first great triumphs of Mr. Spencer was in the discovery of the markings on a specimen of the *naviculacæa*, an infusoria of the waters of the Hudson, sent to him as a test object by Prof. Bailey, of West Point. The professor had a microscope of the last make of Ross, of London, that defined the longitudinal lines of that infinitesimal object, and he thought Spencer's glass would not exhibit them. On applying it Mr. Spencer found not only these, but much finer transverse lines, plainly marked, quite to the confusion and astonishment of the professor. That triumph soon went through Europe, and that test object took the name to this day of the *Navicula Spencerii.* Ross, the celebrated scientist and optical instrument maker of London, set the limits to the powers of glasses. Spencer at an early day far transcended those limits, confounding the most learned in Europe. A professor in the university of Dublin reported to that university the fact of that triumph as having been accomplished by a 'young man of the western forest,' to his surprise and great pleasure. Thus did he invade the old and long obscured formulas, and strike off in a line overthrowing all and leading to such perfection."

The detection of the imperfect adjustment of the great telescope at Washington, after it had been many years in use, characteristically illustrates the acuteness of Mr. Spencer's perception in such matters. Observing that the instrument was not adjusted so as to display its full powers, he

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expressed a desire to fix it. It was thought by Profs. Henry, Maury, and others that the experienced men who had known and used the instrument for years understood it; and they hesitated to allow so young a man to meddle with it. But they finally consented, and after he had manipulated it a short time it displayed powers before unknown, to their great and happy surprise.

Mr. Spencer's rare ability was much appreciated, especially in Europe; and many honors were paid him by scientific men and societies. At the Paris Universal Exposition of 1878 his lenses were awarded a gold medal.

Eider Duck Farms and Feathers.

The *Herald's* correspondent with the United States steamer Alliance gives an interesting account of one of Iceland's peculiar industries. By a long and rigid enforcement of a law against the use of firearms within hearing of the resorts of eider duck, these ducks congregate in vast numbers. The owners of most of the duck farms are engaged in fishing, and all the refuse of the codfish dressed on the islands is thrown out on the water for the ducks to eat. Some of the farmers have lately retired from the codfishing, which in the vicinity of Reykjavik is no longer good; but still the ducks come and build their nests, but not in such great numbers as before. When one sees the treatment the birds get their annual return is strange and unaccountable, for they are systematically robbed by the island owners. In the spring, when the ducks swarm here to search out places between the rocks to build nests in, they, having selected a suitable site, pluck the down from their breasts—that soft, silky down famous the world over as the warmest and softest of coverings. Felt between the fingers it resembles floss silk, it is so soft, and it is as springy as rubber. A great bulk of it can be compressed into an incredibly small space, and when released after a long time it resumes its original size. This first plucking is very abundant, for the bird is preparing for warm weather and is prodigal of its thick under-plumage. The first nest is stolen by the farmers, and the bird, finding it gone, finds still enough down upon its breast to construct another, which in turn is taken like the first. The supply of down on the female is now exhausted, and she calls on the drake, and from his down the nest in which the eggs are hatched is made. In case this nest should be taken the bird seeks another nest-hiding place.

When taken from the nest the down is full of straw, chips, bits of moss, and wads of lichen, and must be cleaned before it is fit for use. The machine used in the process of cleaning is of the most primitive kind, and consists of a sort of harp made of coarse strings of raw seal hide, over which the nest is rubbed. In this operation the dust is driven out, and the room in which it is performed is as cloudy as the carding room of an old oakum walk. The chips of straw, moss, and lichen fall through, and only the down remains under the rubbing hand of the operator. Even in the matter of eider down there is a discrepancy between the real thing and the received notions about it. I have seen eider down presented for sale in New York which was pure white, while the real article is a dark slate color, and when viewed at a distance looks not unlike the fur of the blue fox. There is eider down and eider down. There is eider down taken from birds that have been killed in the far north, there is eider down half from killed birds and half from robbed nests, and there is eider (?) down taken from geese in Long Island and New Jersey and sold to other members of the family in New York. The down from dead birds or even the mixed down is without the virtue of the nest-robbed article, and there is so much adulteration practiced in the business that, even in Iceland, you are liable to be imposed on if you don't purchase from the farmer direct. Iceland down is a special grade in the market and brings better prices than any other at the annual auction held for its sale at Copenhagen. The supply from Iceland is very limited, and only amounts to 7,000 pounds per year.

BREAKFAST SET OF SEVRES PORCELAIN.

The accompanying engraving represents an elegant breakfast set of porcelain from the works at Sèvres, France. It is something to be coveted by every lover of fine things in porcelain. The design and ornamentation show so well in the engraving that no description is necessary.

BREAKFAST SET OF SEVRES PORCELAIN, FOUR-NINTHS ACTUAL SIZE.

Hunting Alligators in Florida.

Parties are hunting the 'gators way down on the Caloosahatchie and Kissimmee rivers, and upon the numerous lakes in that region. Nothing is used except the skins upon the belly and legs, the rough, scaly plates upon the backs of the animals being rejected. The heads are cut off and buried for a few days, until the tusks can be detached. It was announced some days since that one person had collected alligator teeth to the amount of three hundred and fifty pounds. This fact alone will give some idea of the destruction now going on among these creatures. On the St. John's River a new method has been devised for the successful pursuit of this game. A dark lantern with a powerful reflector is used on suitable nights, and no difficulty is experienced in approaching the quarry. The animals appear to be perfectly bewildered by the strong glare, and make no effort to escape. The gun is held within a few feet of the head, a touch to the trigger, and there is a 'gator less in Florida. This new process is very effective, as the hunters are enabled not only to kill but to secure the prey. It is sad to reflect that the race of the saurians is in danger of being extirpated. Thousands are slain annually by tourists and others for amusement merely, in addition to those slaughtered for profit.

Thousands of baby 'gators are stuffed as specimens or sent off alive as curiosities, while myriads of eggs are blown and disposed of by dealers. Amid all these causes combined the brute seems in a good way to become extinct. This is somewhat unfortunate, as the beast is a constant source of interest to our Northern brethren, and every hunter from that section eagerly craves the distinction of adding an alligator scalp to his list of trophies. If their wholesale destruction continues it will be necessary to call on the Fish Commissioners to restock our lakes and rivers with these valuable animals.—*Jacksonville Cor. Savannah News.*

Kind Treatment of Horses.

It has been observed by experienced horse trainers that naturally vicious horses are rare, and that among those that are properly trained and kindly treated when colts they are the exception.

It is superfluous to say that a gentle and docile horse is always the more valuable, other qualities being equal, and it is almost obvious that gentle treatment tends to develop this admirable quality in the horse as well as in the human species, while harsh treatment has the contrary tendency. Horses have been trained so as to be entirely governed by the words of his driver, and they will obey and perform their simple but important duties with as much alacrity as the child obeys the direction of the parent.

It is true that all horses are not equally intelligent and tractable, but it is probable that there is less difference among them in this regard than there is among his human masters, since there are many incitements and ambitions among men that do not affect animals.

The horse learns to know and to have confidence in a gentle driver, and soon discovers how to secure for himself that which he desires, and to understand his surroundings and his duties. The tone, volume, and inflection of his master's voice indicate much, perhaps more than the words that are spoken. Soothing tones rather than words calm him if excited by fear or anger, and angry and excited tones tend to excite or anger him. In short, bad masters make bad horses.

REWARD FOR AN ANTIDOTE TO YELLOW FEVER.—According to the *Eco del Comercio,* the legislature of the State of Vera Cruz offers a prize of $100,000 to him who shall present a true antidote for all kinds of vomiting.

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BOTANICAL NOTES.

Milkweed as an Insect Intoxicant.—A writer in the *Pharmaceutical Journal*, speaking of a visit to Kew Gardens, says: "It is amusing to see the numbers of bees hanging on the sweet-scented flowers of *Asclepias cornuti* (milkweed) perfectly intoxicated, so that they will not move even when roughly touched, one being noticed by the writer to be apparently 'dead drunk' on the ground. The numerous bees which visited the flowers of the teasel seemed to be similarly affected. It would be interesting to learn whether the flowers of the *Asclepias*, which are known to contain a sort of sugar, really do possess an intoxicating principle, since the soma plant of India, alluded to in the Sanskrit Vedas (which some place as far back as twenty centuries B.C.), and the juice of which yielded, by fermentation, an intoxicating liquor, is supposed to be a species of *Asclepias*." The milkweed must have acquired these intoxicating properties through change of soil and climate, since we are positive that they do not exist in the plant in this its native country. We have watched bees gathering nectar from the flowers many a time, but we never observed that it had any intoxicating effect upon them; and we do not believe that any one has observed such a fact here.

How the Seed Buries Itself in the Ground.—A paper on this subject was read at the recent meeting of the British Association by Sir John Lubbock. One of the most interesting parts in botany, he said, was the consideration of the reasons which led to the different forms, colors, and structures of seeds, and it was, he thought, pretty well made out that a large proportion of those might be accounted for either as serving to protect the seed or to assist in its conveyance to a place suitable for its growth. If the seeds of trees fell directly to the ground it was obvious that very few of them would have a chance of growing. It was an advantage to them, therefore, of which many availed themselves, to throw out wings, in consequence of which the wind wafted them to a greater or less distance. Others were transported by animals. and others again were thrown to a great distance by beautiful and wonderful contrivances in the plant. Some were enabled to penetrate the earth, and others sow themselves in the ground. In one of the clovers (*Trifolium subterraneum*), after the flower had faded, it turned downward and buried itself in the ground. The ground-nut of the West Indies, and more than one species of vetch, had the same habit. In the *Erodiums*, or crane's-bills, the fruit is a capsule, which opens elastically, and sometimes threw seeds to some little distance. The seeds themselves were in some cases spindle-shaped, hairy, and produced into a twisted awn. The number of turns on the awn depended upon the amount of moisture. If a seed be laid upon the ground it remained quiet as long as it was dry, but as soon as it was moistened the outer side of the awn contracted and the hairs surrounding the seed moved outward, the result of which was to raise the seed into an upright position. The awn then gradually unrolled, consequently elongating itself upward, with the result that if it was entangled among any of the surrounding herbage the seed was forced into the ground. A still more remarkable case was that of *Stipa pennata*, the seed of which was small, with a sharp point, and with stiff short hairs pointing backward. The upper end of the seed was continued into a fine twisted rod; then came a plain cylindrical portion attached at an angle to the corkscrew, and ending in a long and beautiful feather—the whole being about a foot in length. That end was supposed by Mr. Francis Darwin to act very much in the same manner as that of *Erodium*. Mr. Lubbock did not doubt that the end would bury itself in the manner described by Mr. Darwin, but he doubted whether it always did so. One fine day, not long ago, he chanced to be looking at a plant of that species, and around it were several seeds more or less firmly buried in the ground. There was a little wind blowing at the time, and it struck him that the long-feathering awn was admirably adapted to catch the wind, while, on the other hand, it seemed almost too delicate to drive the seed into the ground, as described by Mr. Darwin. He therefore took a seed and placed it upright on the turf. The day was perfectly fine, and there could therefore be no question of hygroscopic action. Nevertheless, when he returned in a few hours, he found that the seed had buried itself some little distance in the ground. He repeated the observation several times, always with the same result, thus convincing himself that one method, at any rate, by which seeds bury themselves is by taking advantage of the action of the wind, and that the twisted position of the awn, by its corkscrew-like movement, facilitates the entry of the seed into the ground.

Effect of Pressure on Seed Germination.—In a note communicated to *Nature* by Mr. W. Carter, an account is given of the effect of pressure on the germination of seeds. He found that under a pressure of two and a half atmospheres mustard seed germinated twenty-five hours earlier than under the ordinary pressure of the atmosphere; but that the early development became permanently arrested during the eight days of the experiment, and the cotyledons of one that had escaped entirely from the seed coat remained as etiolated as if grown in absolute darkness, while those under ordinary pressure grew rapidly, and their cotyledons became of a deep green color. The etiolated plants, when removed from the pressure, rapidly grew into vigorous young plants. An increased pressure would, therefore, seem to stimulate germination and prevent the formation of chlorophyl. The pressure was obtained by the use of a column of mercury. The seeds were sown on moist cotton-wool, placed in a small bottle, which was then secured to the curved extremity of a glass tube, into the long arm of which mercury was poured until it reached a height of 45 inches above the level of the metal in the short arm.

Poisoning by Carbonic Acid.

It is our painful duty to have to record from time to time fatal accidents in breweries arising from want of ordinary precautions being taken before men are allowed to descend into wells or fermenting vats. In wells there is always a natural evolution of carbonic acid gas, both from the water at the bottom of the well, and from fissures in the rock into which the well is bored. In fermenting vats carbonic acid accumulates from the fermentation which has taken place in them, and even when the wort has been all drawn off, the gas will remain in the vat unless precautions are taken to remove or disperse it. In spite of its high specific gravity and the well known law of diffusion, carbonic acid gas will remain at the bottom of a closed vessel for a considerable period. It has been asserted by some that carbonic acid is not in itself poisonous, but that animals immersed in it die simply from want of oxygen; this is not correct, for carbonic acid exerts a direct poisonous action when respired. Pure air consists of about one part of oxgen and four parts of nitrogen, but if the latter gas be replaced by carbonic acid, an animal placed in such a gaseous mixture will instantly expire, proving that carbonic acid has not the harmless properties of nitrogen.

It has been proved that as little as five per cent of carbonic acid in air will affect birds in two minutes and kill them in half an hour, and it has also been proved that a very small excess of carbonic acid will bring on an apoplectic fit in persons subject to this disease. Even aerated waters have been known to cause giddiness and intoxication when drunk too freely, and the rapid intoxicating effects of sparkling wines are probably due to some extent to this constituent. The instinctive effort to withdraw the face from the surface of a fermenting wort has been experienced by every brewer, and is due to the irritation of the throat produced by the gas, and which causes the glottis to rapidly close itself. It is a very common and wise precaution to lower a burning candle into a well or vat before allowing a workman to descend, but even this is not a sufficient test of security, for a candle will burn in air which contains ten or even twelve per cent of carbonic acid—a quantity more than sufficient to cause immediate death to some persons.

The disastrous accidents which have occurred—we record one in our present issue—ought to lead principals of breweries to take every precaution to protect the lives of their workpeople. The candle test is a most useful one, but too much reliance should not be placed on it; no man should be allowed to enter a fermenting vat without help being at hand, and care should be taken that the aperture through which the vat is entered is large enough to allow of a speedy exit in case of accident. In clearing a vat of carbonic acid, advantage should be taken of the heaviness of this gas; by having an opening in the bottom of the vat the gas will rapidly pour out like a liquid, and in this way the largest vat may be quickly and completely cleared of all carbonic acid. —*Brewers' Guardian.*

Theory of Lighting.

Lord Rayleigh, F.R.S., in a paper read in Section A, British Association meeting, York, says:

It is known that a large part of the radiation from terrestrial sources is non-luminous. Even in the case of the electric arc the obscure radiation amounts, according to Tyndall, to eight-ninths of the whole, and of the remainder probably no inconsiderable part is to be found in the extreme red rays of feeble luminosity. For practical purposes this obscure radiation is useless, and the question forces itself upon us, "Whether or not there is any necessity, absolutely inherent in the case, for so large a proportion of waste." The following arrangement, not, of course, proposed as practical, seems to prove that the question should be answered in the negative.

Conceive a small spherical body of infusible material, to which energy can be communicated by electricity or otherwise, to be surrounded by a concentric reflecting spherical shell. Under these circumstances no energy can escape; but if a small hole be pierced in the shell, radiation will pass through it. In view of the suppositions which we have made, the emergent beam will be of small angle and may be completely dealt with at a moderate distance by a prism and lens. Let us suppose, then, that a spectrum of the hole is formed and received upon a reflecting plate so held at the focus as to return the rays upon the lens and prism. These rays will re-enter the hole and impinge upon the radiating body, which is thus again as completely isolated as if the shell were unperforated. We have now only to suppose a portion of the focal plate to be cut away in order to have an apparatus from which only one kind of radiation can escape. Whatever energy is communicated to the internal body must ultimately undergo transformation into radiation of the selected kind.

REMEDY FOR INTERMITTENT FEVERS.—Dr. Bruneti recommends, as an efficacious remedy in intermittent fevers, a preparation composed of twelve grammes of the chloride of sodium and one gramme of ferric carbonate. This is to be divided into six doses, to be taken in twenty-four hours. To prevent the recurrence of the malady, one dose a day is to be taken for the following week.

MISCELLANEOUS INVENTIONS.

The "Law" system—that is, the *two-wire* system, one of which is used exclusively by all the subscribers of an exchange to talk to the central office to give orders to the operator in attendance, without any signaling forward and backward by bells and annunciators—seems to be the approved method, and will doubtless supersede all other plans in due course of time. Its general adoption has been retarded in a great measure for the reason that no good method has been discovered before of placing the system on circuit wires, or, more plainly speaking, two or more stations on the same wire. Telephonic companies have hesitated to incur the expense of giving each of their patrons a wire for their individual use, preferring to retain the magneto method, with all its faults, by which this could be done. With Mr. Crowley's improvement the Law system has no objectionable feature whatever. All the companies can adopt it now and place as many stations as is desired on the same wire. This improvement has been practically demonstrated on two exchanges, Augusta, Ga., and Richmond, Va., where the subscribers on the same circuit signal and talk with each other without the aid of the central office operator, and at the same time they have the superior method of communicating with the central office at their command, with a view of conversing with other subscribers not on their circuit. This improvement will be an immense advantage in cases where parties have telephones at their offices and manufactories or offices and residences, by being at all times in easy readiness to call their manufactories or families, and *vice versa*, by simply tapping on the little key placed at each station. It requires no awkward turning of a magneto crank and at the same time pushing in a button with certain pauses, giving an *uncertain* ring on the distant bell and annunciator, placing the switch to the right and left, thereby creating delay and confusion, and nine times in ten awakening the "wrong passenger." The day is fast approaching, if it has not already arrived, when the question of *room* to place the increasing number of wires on the street poles and housetops will seriously agitate the telephonic companies. These poles and wires are already unsightly, and in some cities the authorities have objected to any further encroachments. The wires will eventually be placed underground beyond a doubt. An application of machinery or battery, or both, that will work with satisfaction and calculated to reduce the number of these wires, even in a very small percentage, must prove a desideratum with telephonic companies, and will avail themselves of such discoveries without hesitation. The Western Union Telegraph Company appreciated this point by paying an immense sum for the duplex and quadruplex apparatus. Mr. Crowley's invention appears to have this essential point in view, for with judicious location of subscribers on the part of the Law exchange manager he certainly can put two subscribers on a wire where he has only one now without detriment to either, thus practically "duplexing" the wire. Managers of "magneto" exchanges will now be enabled to discard their old-time method and adopt the new at a minimum cost and inconvenience, and give their patrons an equivalent for their money.

An improved bobbin has been patented by Mr. Albert H. Carroll, of Baltimore, Md. This invention relates to an improvement in that class of filling bobbins for the shuttles of looms in which the head or cone is provided at its end with a transverse slot to receive the lug of the winding spindle when the bobbin is being filled, and in which a notch or cut is made in the sides of this head or cone to receive the spring of the shuttle, which holds the bobbin in place in said shuttle.

Mr. Gregory Lukins, of Sweetwater, Ill., has patented a composition of matter for preserving wood, consisting of carbonate of potash one part, saltpeter four parts, and common salt two hundred parts.

Mr. William Beeson, of Dillon City, Montana Territory, has patented a new flying ship or machine for soaring in the air by aid of the wind and gravitation. The invention consists in a boat or so-called "basket" or "car" provided with two uprights gradually separating from each other toward the top, and provided with transverse bars, to which sails are attached and stretched from one upright to the other, the ends of these transverse bars being connected by ropes wound around a drum provided with a crank, by means of which the inclination of the sails can be varied at will.

An improvement in the manufacture of sugar has been patented by Mr. Emil Fleischer, of Dresden, Germany. This invention relates to the manufacture of sugar from saccharine solutions, such as sirup, treacle, etc., by means of a bibasic saccharate of strontia, and in the apparatus in which the strontia sugar that has been formed is separated from the non-saccharine liquid. This invention consists in producing a bibasic saccharate of strontia, which is separated from the non-saccharine liquid and placed into cold chambers, in which the strontia crystallizes and is separated from the sugar.

Mr. George W. Ellis, of Philadelphia, Pa., has patented an improved truss for reducing hernia, in which the pad is attached to the spring by means of a metal bar having a spherical head that is confined between two clamping plates or jaws, forming a permanent and rigid attachment of the spring.

An improved swing which can be conveniently suspended from the walls of a room, and which can be operated by the person occupying the seat of the swing, or by a person in any other part of the room, has been patented by Mr. Joseph A. Tunnington, of Elyria, Ohio.

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An improved car wheel mould has been patented by Mr. John Forbes, of Harrisburg, Pa. This invention relates to certain improvements in car wheel moulds of that form in which the metal is poured through a central hole in the core and rises into the wheel space from the bottom; and it consists in forming a hollow core with an annular re-enforcing metal stiffening in it, perforated to permit the passage of air and gas through it, and combining this with the drag-sand, which is formed with a circular recess to receive the lower end of the core, and radiating channels that connect the hole in the core with the wheel space.

The flat link chains in common use are made of links riveted together, the strength of the chain being determined by the quality and size of the rivets and their resistance to the shearing strain or pull of the links, and when a link breaks one or two links have to be cut out and a new link put in, and new rivets also, which latter must be upset. Hence the operation of repairing a flat link chain of ordinary construction is slow and expensive. Mr. James T. Brough, of Jacksonville, Fla., has patented an improvement intended to facilitate the repairing and lengthening and shortening of flat link chains. The improvement consists of a flat link chain having the thick or double link made with both faces recessed and socketed at each end, the socket being undercut, and in forming each single link with a flat-headed stud projecting at right angles from one face at each end. The chain is made by coupling the double and single links together by means of the engagement of the studs on the latter in the undercut sockets of the former.

An improved apparatus for the water packing of snow-roads has been patented by Mr. Henry I. Grennell, of Medford, Wis. The object of this invention is to water pack the snow in the runner-tracks of snow-roads, and thus form a solid path way for sleighs. The invention consists of a sleigh carrying a water tank and heater and suitable conducting and delivering pipes, whereby the water may be heated and the hot water delivered into the runner-track of snow-roads to pack and solidify the same.

Mr. William T. Hall, of Fayetteville, Ind., has patented an improved stock car. The invention consists in dividing the interior of the car into compartments or stalls by a series of hinged posts connected by hinged end partitions and separable side partitions.

There are various methods of pivoting the natural roots of human teeth, but they fail or are defective in the matters of strength and firmness and in preventing the decay of the root. Dr. Henry W. F. Büttner, of New York city, has patented an improvement in artificial teeth, which consists in turning down the upper end of the tooth root, so as to form a circular shoulder thereon, the irregular upper surface of the tooth being cut off in a horizontal plane to accurately fit the metallic cap which carries the artificial crown. A cap fits upon the root, and it has an artificial crown attached to it.

Mr. Isaac T. Tichenor, of Auburn, Ala., has patented an improved material for making bags, which is impervious to atmospheric moisture, is not destroyed easily by the corrosive action of the contents of the bag, and is rendered strong and durable. The invention consists in a coarse cloth, such as a burlap, which is covered on one or both sides with a mixture of clay and tar.

Mr. John J. Tierney, of New York city, has patented an improved door securer, consisting in the combination with a screw, for securing a door, of a post socket having on its forward end the right angled plate fitting into a rabbet of door post and secured by screws, so that a burglar cannot remove the socket, even after he has withdrawn the bolt.

Mr. John B. Bennett, of San Luis Obispo, Cal., has patented an acoustic or mechanical telephone in which certain improvements render the instrument more efficient in giving a louder and clearer sound than has hitherto been obtained. It is of such construction that it can he placed in almost any place or position required.

THE GASTROSCOPE.—AN ELECTRIC LIGHT FOR THE HUMAN STOMACH.

The application of electricity in ways the most varied, and, perhaps, we might add, unexpected, has, within the last few years, developed with almost bewildering rapidity. As in so many other things, it has its applications also in medicine; perhaps one of the most novel and ingenious of these, as well as the least generally known, is the employment of the electric light to illuminate various parts of the body which are only obscurely visible, if they can be seen at all, under ordinary circumstances. There have been many instruments, says Mr. H. Wilson in the *English Mechanic*, designed to facilitate in this way the diagnosis of the less accessible cavities of the human frame. The ordinary instruments are constructed to reflect the light either of day or of some artificial source upon the part to be examined. The bright tablespoon which a medical man will often use to help him to see a sore throat more clearly by reflecting additional light upon it, is of course a primitive form of such instrument. In some of the most recently perfected of these appliances a small piece of platinum joining the electrodes from a source of electricity, is placed in the focus of a small mirror. By allowing a carefully regulated electric current to circulate through the wires the platinum is, of course, raised to a white heat and emits a brilliant light. This is reflected upon the part to be diagnosed, which is thus made clearly visible to the operator. Instruments for viewing the interior of the bladder, the œsophagus, or the stomach (for this unruly and mysterious source of trouble is no longer to escape the searching gaze of science), are necessarily more complicated than those for diagnosing, for instance, the mouth or the ear.

We select the gastroscope for viewing the interior of the stomach, as the most ingenious and remarkable of all these instruments which have recently been brought to great perfection in Vienna, and also as showing to what a point of delicacy the execution of scientific instruments has been carried in our day. We should add that the gastroscope is not a mere model or plaything, but has been in actual use. A figure of the complete instrument is shown in the two blocks, Figs. 1 and 2, and reference to it and to the smaller cuts will enable us to explain the principal features, which will, we think, interest all lovers of ingenious mechanical appliances.

The gastroscope consists mainly of a rigid horizontal tube, Fig. 1, *a*, terminating in one direction in the eyepiece, L, and in the other prolonged into a partially flexible tube, which can be passed down the œsophagus until its end reaches the stomach. This flexible metal tube, Fig. 2, is formed of 60 annular pieces, united by lateral joints, and thus forming a completely closed tube, whether it be disposed in a straight line or in a curve, without any chinks or openings, in which, did they exist, the folds of the mucous membrane might easily be caught and lacerated. This close-fitting arrangement is effected by making the inside of the upper end of each annular piece taper outward, and the outside of its lower end taper inward to an equal extent, so that one piece fits into another. As this tapering is only effected out of the thickness of the metal, this gullet-pipe constitutes a tube of uniform diameter both within and without. Moreover, the edge of each of these annular joints is filed away on opposite sides; on one side to a considerable extent, so as to enable it to be bent into a spiral, but on the opposite side only enough to allow it to be opened out till it forms a straight line. A glance at Fig. 2 will best supplement this explanation.

The jointed flexible tube terminates in a sort of tiny lantern, *z*, which consists of an inner and an outer glass tube-head. Inside the inner glass is seen the little loop of platinum wire, P*t*, the ends of which are of course joined to wires which run up the interior of the tube and can be connected at pleasure with the electrodes of a battery, by means of the screws, *d* and *n*, Fig. 1, and thus cause the incandescence of the platinum, which furnishes the illumination From this, light radiates freely on all sides and illuminates the interior of the stomach. A portion of the rays which fall upon the side opposite to the little window, O, Fig. 2, situate immediately above the lantern, *z*, are of course reflected back into it, where by means of the prism, P*r*, Fig 3, they are reflected upward in the vertical direction of the tube. Passing through the series of lenses, L*i*, they are parallelized, and arriving at the bend, L*t*, Fig. 1, are deflected by refraction to a horizontal direction by the coupled prisms about to be described, and seen in Figs. 4 and 6, whence, reaching the eyepiece at L, they convey to the observer's eye an image of a portion of that side of the stomach which may be opposite the window, O.

In order to deflect the rays of light from the vertical direction of the tube. *s*, to the horizontal one of the tube shown in Fig. 1, which terminates in the eyepiece at L, prisms are employed in the bend at L*t*. Fig. 4 shows the arrangement of these prisms, which are coupled immovably upon the curved piece of metal, *bg*, and are attached at their apices on very narrow metal supports, *st*, *st*, to the curved plate, *pl*, the exterior of which is seen in the under side of the bend at L*t*, Fig. 1. (Fig. 5 represents the guide-tube without this plate.) The most ingenious feature of this arrangement is that it allows the gullet-tube to move freely backward and forward through the curved outer tube or guide, Fig. 5, and yet at the same time maintains the prism in a constant position. This is effected thus: The guide-tube, Fig. 5, has a small oblong aperture, O*e*, on the under side, which is of just sufficient size to allow the insertion of the prisms one after another. The aperture itself is prolonged into a slit for some little distance in the direction of the lower end of the tube. A corresponding slit in the tube, *s*, Fig. 1, slides along the prism supports, which thus offer no obstacle to the motion of the gullet tube, which in this manner is movable within the outer tube, while the latter and its inclosed prisms retain a constant position. This arrangement will be better understood by a reference to the sectional drawing of the two tubes and prism plate, Fig. 6.

To obviate the inconveniences which might arise from any elevation of temperature in the stomach, the space between the two glasses of the lantern is kept filled with water, and communicates with two diminutive caoutchouc pipes, *rr*, conveyed down the main tube, as seen in the sectional drawing, Fig. 7, and terminating in the bent nozzles, *c c'*, Fig. 1. To these further India-rubber tubes are adapted, one to supply, and the other to lead off the water which is thus kept in perpetual circulation, and the temperature of which has of course to be regulated so as to obviate any inconvenient degree of heat produced in the stomach.

The crowning piece of contrivance and delicate workmanship in the instrument is an elegant appliance, by which the extremity of the gullet-tube, with its little window, may be made to revolve. The operator has merely to turn the little milled wheel, R*l*, Fig. 1, round which is stretched the silk cord, *fd*. The latter passes down the tube and round the tiny wheel, *kr*, shown in the section of the tube, Figs. 8 and 9. This tiny wheel, which, it will be observed, is toothed, plays into an indented ring round the interior of the lower rotatory portion of the tube, Fig. 9, which it can by this means cause to revolve whenever motion is imparted to itself by the agency of the silk cord which communicates with the milled wheel, R*l*, placed conveniently near the eyepiece. This ingenious and delicate contrivance obviates the neces-

Fig. 1.

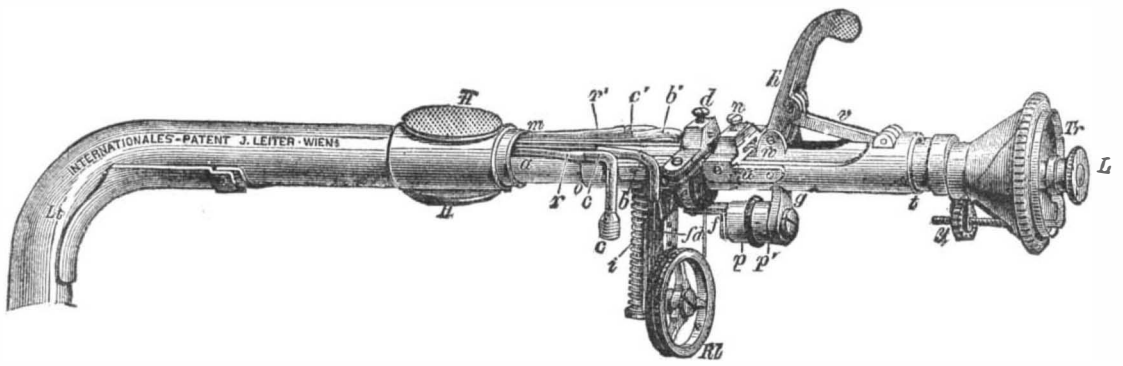


Fig. 3.

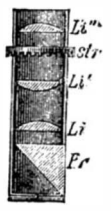


Fig. 2.

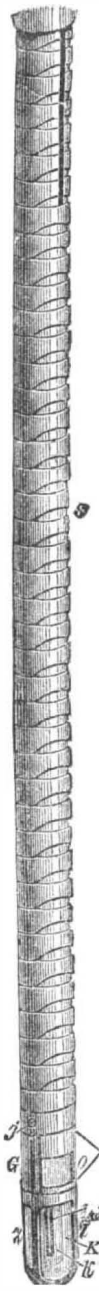


Fig. 4.

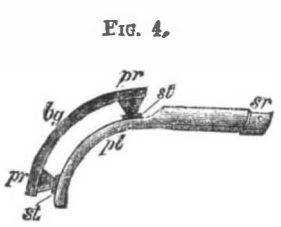


Fig. 5.

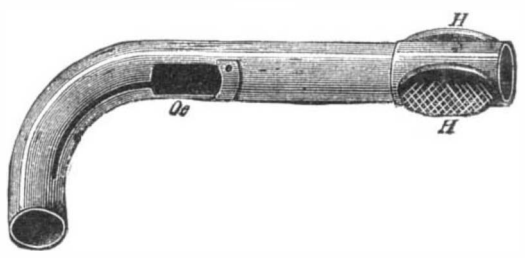


Fig. 6.

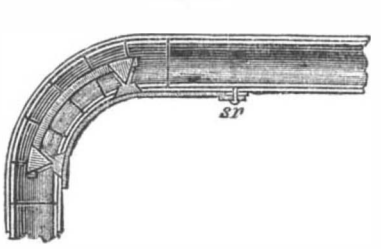


Fig. 7.

Fig. 8.

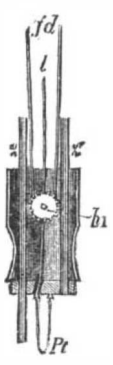
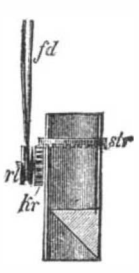


Fig. 9.



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sity there would otherwise be of withdrawing, readjusting, and reinserting the instrument in order to observe different portions of the stomach, for the slightest turn of the wheel, R*l*, causes a corresponding movement of the terminal of the gullet-tube with its window, and thus makes different parts of the interior circumference of the stomach successively visible to the eye of the diagnoser. Wherever a small supply of electricity is to be had, there the instrument may be used. A small portable apparatus for preserving a sufficient quantity of electricity has been designed by the maker, and now that the storage of electricity has become a recognized possibility, the ingenious instrument we have very briefly described may probably prove a welcome aid to the medical man in throwing a new light upon the stomach, that mysterious source of so many of "the thousand natural shocks that flesh is heir to."

Woolen Thread.

BY CHARLES VICKERMAN.

I have said that our worsted friends could spin our forty skeins wool into an eighty skeins worsted—a pure worsted thread is the smallest or highest state of tenuity into which wool can be got as a textile thread, and a pure woolen thread is the converse of this, it is wool in its thickest form or lowest state of tenuity as a textile thread. In worsted all the wool is available to go into the body of the thread, as the fibers are just laid end to end and parallel to each other. In the woolen thread, owing to its peculiar construction, part of the fiber is required to form that outside fringe, and the body or core of the woolen thread has not the fibers parallel. Thus the one stands at the North Pole and the other at the South Pole of the wool industry.

I wish it distinctly to be understood that I quarrel not with people as to the kind of yarn they prefer; that is their lookout, not mine. I aim only to place before the reader a scientific definition, and if he is not content with the forty skeins got out of the wool we have been considering, send part of the wool into Belgium, and he will get it spun to 55 skeins. You have a perfect right to have your own way, and to be pleased with seeing and having a nice yarn, small spun, as well as anybody else—some people have quite a passion for a deal of yard stick, give them plenty of length for their money, and they are satisfied. Got your yarn back from Belgium, have you? Yes, and *spun to fifty-six skeins.* Like it? Yes, it's beautiful, beats the English yarn hollow—it's smart, clear, and glossy, it's quite a coat on its back—the English yarn looks rough and hairy when laid alongside that I am quite ashamed of it; the Belgian yarn is immensely superior; it's a most beautiful yarn, and besides and better than all, *I have sixteen skeins more length* (there goes the yard stick again). Beautiful yarn, is it? Yes, *very beautiful indeed!* Allow me to remind you again that beauty is in the eye of the beholder, and it depends upon what the beholder understands by what he sees, and that again depends upon the correctness of the beholder's knowledge and perception of what is beautiful.

You have reckoned up the "haves" in respect to this Belgian yarn—you have more skeins—you have more smartness—you have more *clearness*—you have more *beauty.* Have you reckoned up and deducted the "*have nots?*" You have sixteen skeins more length, but on one side of the "have nots" you have sixteen parts lost of the *wooleny* character of the yarn. W-e-ll, but I don't see it in that way. I don't suppose you do; but whatever you want more than about half the worsted length, can only be had by sacrificing a corresponding proportion of the *wooleny* character of the yarn. You must not expect that you can be allowed to run off with all the sixteen skeins extra length and retain the *same wooleny* character in the yarn. You can have either one or the other, but you must not think to run off with both. You have got sixteen parts more length, then you have only twenty-four parts left of the wooleny character—fifty-six skeins of the length added to the twenty-four of the wooleny character make up the eighty skeins of the worsted spinner, at which point every vestige of wooleny character is gone. Try the carpet worsted spinner if you like, and get sixty-six skeins out of your wool, and then you will have only fourteen parts of wooleny character left to make up the eighty, where the game ends.

By carding as the Belgians do *you lay* the fiber of the wool *more toward the worsted form,* and that is the reason why you can spin it further, but it is at the expense of the *wooleny character*, and the yarn is all the less worth when it is spun. The Belgian system of carding is simply combing on a carding machine, as far as that is practicable; it is lashing out the fiber and laying it as much toward the parallel as possible. The Belgian carder does not use his stripper, nor does he use his fancy as we do—the strippers don't touch the workers, nor does the fancy work into the cylinder card. So that with cards set in this manner nothing but clean all-wool work could find its way through the machine, and that only in a lashing, combing manner. You can give what name you like to such a mode of working, but it certainly is not carding for woolen in its truest and best sense.

Oh! but the Belgian card is a "*specialty*," chimes in some one, and calculated only to work pure wool. To all such specialty talk I beg to reply that the Belgian card will do almost any kind of work, and that is the best finishing card in the world; but that as a breaker card it is neither fit to work in Belgium nor anywhere else. Its true position is that of a finishing card, in which position, when properly worked with a proper fancy, it will turn off work in mixtures, mungo and wool, as well as pure wool, in such a style as no other card can. But I must not go into the subject of carding, as it is a subject of wide range, and has ample material in it for discussion.

There is one part of my subject, and that is the use, or uses, to which woolen yarn can be applied; and as a preliminary to that we must fix in our own minds which way to twine it, whether "*crossband*" or "*openband*," and that again will depend upon the class of work we intend to use it for, whether for plain goods or for fancy goods. In the production of fancy cloths, whether in self color or in various colors, design or pattern has to be aimed at, and this involves sharpness of outline; and in order to *obtain* and *retain* this sharpness of outline, not only must the warp and weft thread cross each other at right angles, but the folds of the twine of the warp and weft thread must cross each other at right angles also, to enable the threads to retain their distinctness of individuality in the fulling *or milling and the finishing.* In using warp and weft spun the same way of twine, the folds of twine *do* cross each other at right angles in the cloth, thereby removing, as far as possible to remove, the liability of the fibers, and even of the threads themselves, to mingle bodily in the milling.

If our object in using our woolen yarn is to make a plain cloth, such as a doeskin or a superfine black broad, where it is requisite to hide the make of the cloth, then in order to obtain this result the weft requires to be twined the opposite way to the twine of the warp, in order to afford the greatest facility for the fibers mingling quickly, and felting and forming one homogeneous mass, hiding every vestige of the "make" or framework of the fabric. In the fancy cloth you require to preserve as much as possible the individuality of the threads for the sake of the pattern; in the plain cloth you require to lose it as quickly as possible in order to obtain the closeness of face and cover for the finisher to operate upon, and to do this the folds of the twine in the weft require to meet with, or fall in with the folds of the twine in the warp, *and not cross them at right angles* as in the fancy cloth. By using opposite twine for warp and weft in a fancy cloth you get closeness and evenness of face as in the plain cloth, but you sacrifice distinctness of pattern in doing it.

I need not attempt to name the variety of cloths for the make of which woolen yarn is useful—from the flannels we wear, and the blankets we rest upon after our day's toil, down through every kind of cloths, their name is legion—but will ask attention to one of the leading features of its use. The very peculiar structure of the woolen thread eminently fits it for the make of all kinds of cloth that require to be felted or "*milled.*" The worsted thread we have been considering is from identically the same wool, but its formation precludes it being made into goods where much felting is required. If you attempt to mill a fabric made from worsted to any considerable extent the material will gather up into beady lumps which we call "*nigger heads,*" the structure of the worsted thread is not fitted for felting or milling, whereas the woolen thread from its very structure is, in the highest degree, fitted and adapted for all kinds of fabrics where felting is requisite. As an extreme instance of its power of usefulness in this direction I may mention that the Greenland whale fishermen's stockings are knitted wide enough and long enough to admit of being drawn over and to cover the entire men's bodies, and are then taken and felted or milled down to the proper size in order to give them the thickness and warmth necessary to withstand the rigor of that northern region. The Scotch Highlander's cap, or bonnet as he calls it, is often knitted the size of a cartman's hay net, and then felted down to the size of the human head, hence their extraordinary wear. Another instance of the power of combination and strength through felting is the mysterious Gordian knot, of which we read in history, which promised the empire of the world to him who could untie it, and Alexander the Great is said to have cut it into two with his sword because he failed to untie it. This celebrated legend, if not altogether fabulous, is supposed to have had its foundation in the illustrious Gordius having cunningly felted his compound knot before hanging it in the temple.

Those tiny fibers, so insignificant and weak in themselves when tested separately, yet in combination and felted they are capable of being formed into a fabric that will resist tearing to an enormous degree, and are capable of resisting untold tons of pressure—in fact, no amount of pressure hitherto known, not even the hydraulic, can compel a wetted woolen fabric to yield up its water, yet the same fabric when relieved of its pressure and taken and hung up by one end, will quietly and of its own accord, drop by drop, yield up the water which it refused to yield to all the force that could be brought against it.

The cause or means by which, till lately, this very extraordinary and very mysterious process of felting is accomplished is the presence of these minute and curiously laminated scales that I have spoken of as being in immense numbers upon the stem of each hair or fiber of wool; and as in carding and spinning we had to use oil to prevent these scales locking into each other, so in the fulling or milling we have to pursue an opposite course, and apply soap to overcome any remains of grease that may have been left in the fabric, as no felting can be commenced until all the grease has been overcome. By the application of liquid soap we can clean out and open the mouths of these tiny scales; they open their mouths to soap like the flowers open to the sun, and hook into each whenever the fibers touch. Till recent years the greatest philosopher could not explain to us the principle on which the felting effect was produced in wool—there was the practical fact for thousands of years unexplained. To the presence of these scaly excrescences upon the hair or fiber of wool, and to the peculiar structure of the woolen thread, we owe those very remarkable transformations of textile fabrics from the loose, open, unserviceable, friable textures into those compact, unfriable, wear-resisting fabrics, which when fully milled and of fine quality result in those magnificent cloths made in the west of England.

The Magnesia Industry.

If we cause a solution of magnesium chloride to be absorbed by dry slaked lime, the magnesia set at liberty plays the part of a cement, and the matter may be moulded into small porous fragments. If one of these fragments is suspended in a solution of magnesium chloride, after some days the lime is entirely substituted by hydrate of magnesia. The fragment has been the seat of a double diffusion; the magnesium chloride has diffused itself from without to within, and is changed in the fragment into calcium chloride, which in turn becomes diffused from within to without. These two diffusions are simultaneous, and come to an end when all the lime has been substituted by magnesia. Here, then, is a means of reducing into a small volume a precipitate which would have occupied the entire bulk of the solution, if the fragment of lime had been stirred up in it at first. The same phenomena are produced if a great number of such fragments are heaped up in a suitable vessel, where a solution of magnesia is made to circulate slowly from the top to the bottom. In five or six days the conversion is complete; the solution may be replaced by pure water, and the magnesia washed completely. On stirring up it becomes a white pulp, which, if dried in the air, gives a very friable mass. It is hydrated magnesia which may remain for a long time exposed to the air without becoming notably carbonated. Its purity depends on that of the lime employed. In working on the large scale the author uses a paste of lime, which he forces through a plate of metal pierced with small holes, so as to eliminate stones and unburnt pieces. If these "worms" fell upon the ground, or into water, they would at once return to their pasty state. He therefore receives them in a solution of magnesium chloride, where they become at once covered with a slender coating of magnesia, which consolidates them so well that they may be heaped up to the height of 1·50 meters, still leaving between them the interstices needful for the circulation of the liquid. The paste of lime should contain from 34 to 36 per cent of anhydrous lime. The solution of magnesian salt should contain from 25 grammes to 40 grammes of anhydrous magnesia per liter. The laws of diffusion laid down by Graham are here at fault. The acceleration of the phenomena, due to an increase of strength, is balanced by the resistance opposed by a more consistent deposit of magnesia. The presence of sodium chloride, always abundant in the water of salt marshes, is indifferent. Soluble sulphate must be removed by adding the water from a former operation, rich in calcium chloride, and allowing the calcium sulphate to settle, after which the clear liquor is run off for treatment.

AGRICULTURAL INVENTIONS.

Mr. George H. Fowler, of Taughannock Falls, N. Y., has patented a horse hay-fork constructed with grappling bars hinged to each other by a cross head clevis. Trip levers are provided to receive the trip rope, whereby the loaded tines will be locked in place automatically, and unlocked by operating the trip levers.

Mr. Abner D. Dailey, of Riley, Ind., has patented a self-acting rest or support for the tongue of a harvester or similar machine, whereby the necks of the animals drawing the machine shall be relieved of the increased weight which is thrown upon the tongue when the machine comes to a stand.

An improved fertilizer distributer has been patented by Mr. John C. McCaskill, of Shoe Heel, N. C. This invention relates to improvements in that class of fertilizer distributers in which the feed hopper carrying the fertilizer and provided with a cut-off is secured to a plow beam, and it consists of a reciprocating cut-off having both its edges sharpened, whereby less power is required to operate the cut-off, and the lumps are divided by the cut-off.

The Destroyer of the Spruce Trees.

Maine's lumbermen—and, therefore, a large part of the rest of her citizens—are much disturbed by the destructive insects which are killing the spruce trees not only in that State, but in the adjacent British Provinces. The pine has lost its pre-eminence, and the spruce was getting in a position to be the representative tree, but the *Urocerus albicornus*, if the thing has been correctly identified, the Augusta *Journal* says, is killing off the spruce faster than the lumbermen could have done it, and greatly to their detriment. The white-horned *Urocerus*, for that is what his name means, is about an inch long and with wings which spread to two inches. They are as likely to destroy the pines into which they bore as the spruces, so far as the entomologists know. These insects are very prolific, and not at all uncommon. In England it has been often noticed and recorded, but there it was injurious only to ornamental trees, not to those on which so much depends in a business way and in whose preservation so many people are interested as the spruce forests of the Northeast. The prospect seems to be that things will go from bad to worse. Unless some smaller insect comes to the front and destroys the eggs of the *Urocerus*, it is hard to see what is going to save our spruce trees.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

$30,000 cash will be given as a bonus to secure location of satisfactory manufacturing establishment in growing Western town, near good coal and having competing railroads. Address, with references, Western Town. Box 773, New York, stating character of business and present capital.

Mechanics' Watch,$10. Circul's free. Birch,38 Dey St..N.Y.

Turkey Emery, Star Glue, Pumice, Walrus Leather, Polishers' Supplies. Greene, Tweed & Co., 118 Chambers St., N. Y.

Patent for sale.—G. Neu, 171 W. Liberty St., Cin., O.

Davis' Invalid Bed, described in another column, with husk mattress, hair or cotton top, $25. Rights for sale. Geo. B. Davis, Richmond, Va.

Machinist and Fine Tool Maker wanted. One that has had experience on watch tools and fine model work. Steady employment and pay every week. Wm. Essick & Co., Reading, Pa.

Second-hand Upright Engine, in excellent order, for sale. 6 to 8 H.P. Trump Bros. Mach. Co., Wilmington, Del.

Rolled Nickel Anodes, Grain Nickel, Nickel Salts, Platers' Supplies. Greene, Tweed & Co., New York.

Constant Current Electric Generator. Price, $3. Constant Current Cure Company, 207 Main St., Buffalo, N. Y. Send for circular. See advertisement, p. 253.

For Sale.—A complete set of Patterns, Flasks, and Core Arbors, for making Cast Iron Flanged Pipe, Elbows, Tees, and Greenhouse Fittings. Will be sold low to clean out a branch of a business. Address C, Box 1358, New York.

A pair of 15 x 24 Engines, good as new, for sale cheap, as they must be removed. J. C. Todd, 10 Barclay St., N.Y.

Superintendent wanted.—A man competent to superintend a works employing about 300 hands in building machinery and tools, and in manufacturing goods for a regular trade. None but a first-class man in all respects need apply. Address B, Box 2333, New York.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 236.

New Comb'd Milling and Gear Cutting Machines, large range. C. A. Condé & Co., Makers, Philadelphia, Pa.

A valuable article on the Treatment of Acute Rheumatism, by Alfred Stillé, M.D., will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 299. Anything from the pen of this eminent and experienced physician is interesting and instructive.

Foot Lathes, Fret Saws, 6c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Cope & Maxwell M'f'g Co.'s Pump adv., page 254.

Punching Presses & Shears for Metal-workers, Power Drill Presses. $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

Peck's Patent Drop Press. See adv., page 269.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N. Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 238.

The Sweetland Chuck. See illus. adv., p. 238.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

Skinner's Chuck. Universal, and Eccentric. See p. 236.

For Machinists' Tools, see Whitcomb's adv., p. 238.

Draughtsman's Sensitive Paper. T.H. McCollin, Phila., Pa.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p. 254.

4 to 40 H P. Steam Engines. See adv. p. 254.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

Supplee Steam Engine. See adv. p. 270.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 285. Totten & Co., Pittsburg.

Saw Mill Machinery. Stearns Mfg. Co. See p. 269.

Paragon School Desk Extension Slides. See adv. p. 269.

Brass & Copper in sheets, wire & blanks. See ad. p. 269.

CONSTANT CURRENT CURE COMPANY,
207 Main St., Buffalo, N. Y.

SIRS: I am compelled to say that, contrary to my expectations, the Generator you sent me has performed a miraculous cure in my case. For seven weeks I had been almost distracted with neuralgia in my head. I had tried every prescription and remedy known, but without avail. When your package came by mail, I applied the electrodes with little hope for relief I confess; but *in twenty minutes the terrible pain that had been torturing me for seven weeks* DISAPPEARED ENTIRELY. I consider it only justice to acquaint you with these facts.
R. R. GREER, 270 Leonard St., Brooklyn, E. D.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 269.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Wren's Patent Grate Bar. See adv. page 269.

Millstone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau street, New York.

The I. B. Davis Patent Feed Pump. See adv., p 270.

The Improved Hydraulic Jacks. Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser Mfg. Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 269.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 270.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 268.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

New Economizer Portable Engine. See illus. adv. p. 270.

Fine Taps and Dies in Cases for Jewelers, Dentists, Amateurs. The Pratt & Whitney Co., Hartford, Conn.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Improved Skinner Portable Engines. Erie, Pa.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) F. G. asks how to make a good cement for fastening sheets of pasteboard together. It must be waterproof. A. Good pitch and gutta percha (about equal parts) are fused together, and to nine parts of this are added three parts of boiled oil and one-fifth part of litharge; continue the heat with stirring until thorough union of the ingredients is effected. This is applied hot or cooled somewhat, and thinned with a small quantity of benzole or turpentine oil.

(2) A. B. B. asks for a simple and reliable method of testing coal oil. A. Place a small sample of the oil to be tested in a cup partially immersed in a vessel of water, and having placed the bulb of a good thermometer in the oil, heat the water gradually, and as the temperature of the oil rises apply the flame of a burning taper to its surface, and note on the thermometer the degree at which it inflames. This should not occur below 120° Fah. Many of the standard oils inflame only at temperatures 150° or higher.

English Patents Issued to Americans.

From September 13 to September 23, 1881, inclusive.

Albumen, manufacture of. W. H. Hillman, N. Y. city.
Cigar lighter. C. H. Vibbard *et al.*, Aurora, N. Y.
Corset, M. Cohn. New York city.
Crayon holder. C. W. Livermore, Providence, R. I.
Door knob. C. C. Harrington, Newton, Mass.
Dynamo-electric machine (2), T. A. Edison, Menlo Park, N. J.
Electric cable, P. B. Delany *et al.*, New York city.
Electric lamp, E. M. Fox, New York city.
Electric lamp. A. E. Brown, Cleveland, Ohio.
Electrical alarm apparatus, H. C. Roome, Jersey City N. J.
Fastening device for dash boards, C. F. Littlejohn *et al.*, New Haven, Conn.
Hair pin, Mary T. Foote. Boston, Mass.
Heel blank machine, J. W. Brooks, Boston, Mass.
Lamp burner, W. Painter, Baltimore, Md.
Life boat, G. B. Berrell, Pennsylvania.
Needle. R. Crowley, New York city.
Paving block, W. Hunt, New York city.
Reflector, W. Wheeler, Massachusetts.
Railway signaling apparatus (2), W. W. Gary, Boston, Mass.
Sawing machinery, F. Myers, New York city.
Sewing machine, F. G. Altman *et al.*, Medina, Mo.
Show case, L. G. Blood, New York city.
Stitching buttons, Morley Sewing Machine Company, Holyoke, Mass.
Telegraph cable, J. B. Henck, Jr., Boston, Mass.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 27, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Inside Page, each insertion - - - 75 cents a line.
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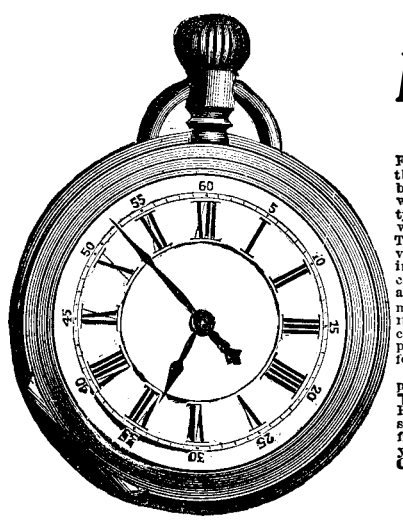

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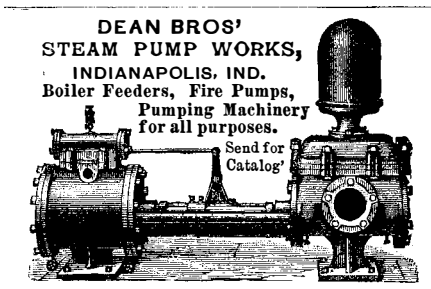

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Letters Patent, No. 46,364, date of issue February 14, 1865, relates to elastic and non-elastic feed rollers, with gauges, slides, etc.

Patent No. 50,140, issued September 26, 1865, relates to check link for limiting spring bar, with attachments.

Patent No. 61,543, issued January 29, 1867, relates to sharp-edged fertilizer feed slides, with attachments.

Patent No. 61,544, issued January 29, 1867, relates to axles, gear wheels and shields, etc. (subject to State rights of Henry Kuhlman to manufacture in Illinois and Missouri).

No. 61,545, issued January 29, 1867, relates to fulcrum placed between boot and spring hoe; also, vibrating seats, etc.

No. 90,556, issued May 25, 1869, relates to fertilizers and wheat sowers, with gauges opening each way from the center.

No. 104,854, issued June 28, 1870, relates to double acting reversible movement of fertilizer feeder.

No. 105,810, issued July 26, 1870, relates to slide block for adjusting the angle of spring hoes.

No. 105,811, issued July 26, 1870, relates to double rotary fertilizer sower.

No. 137,929, issued April 15, 1873. A peculiar arrangement of locking bars or hoe shifting.

No. 150,328, issued April 28, 1874, relates to improved slide blocks, with attachments.

No. 153,345, issued July 21, 1875, and reissued as No. 8,343 and No. 8,344.

No. 8,343 relates to throwing axle rail out of way of hoes.

No. 8,344 relates to portable hoe shifting rails.

Each of the above patents expires seventeen years from date of issue.

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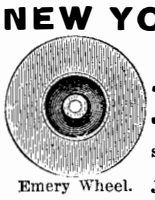
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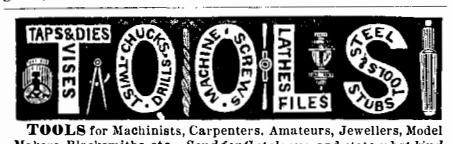

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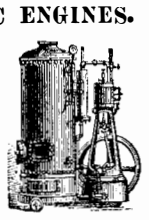

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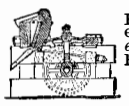

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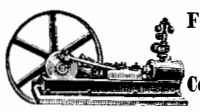

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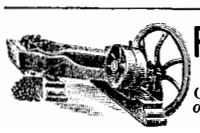

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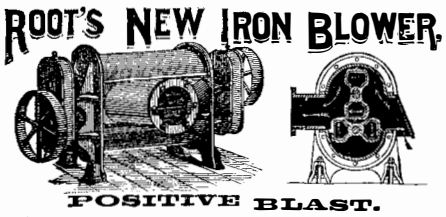

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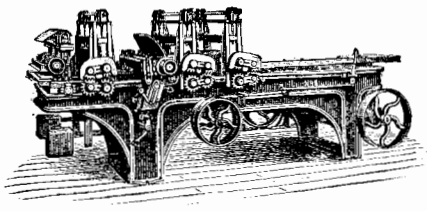

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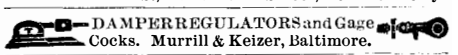

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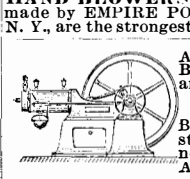

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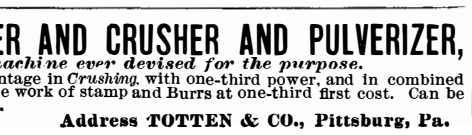
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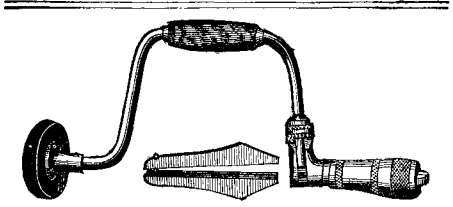

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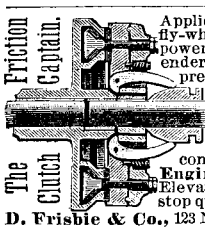

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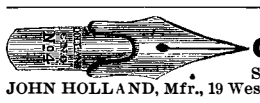

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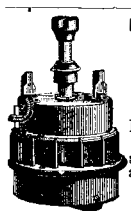

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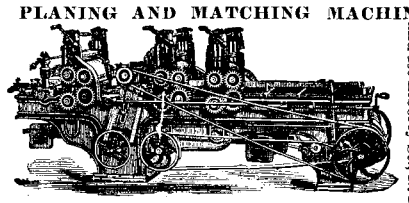

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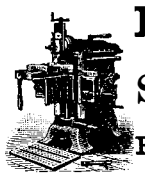

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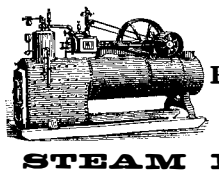

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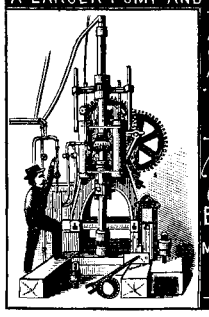

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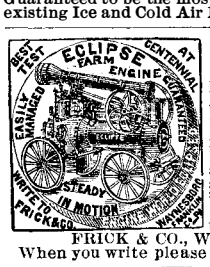

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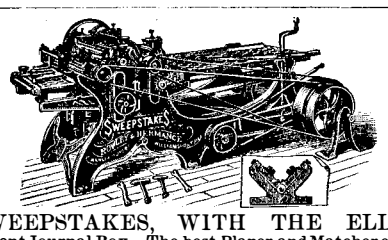

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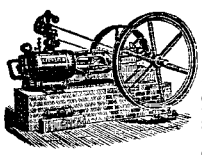

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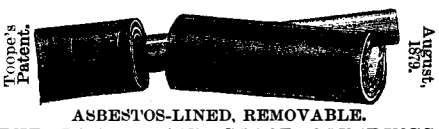

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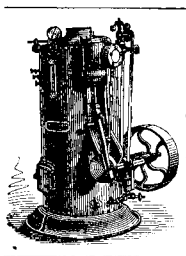

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